TRANSACTIONS

OF THE

AMERICAN

SURGICAL ASSOCIATION.

VOLUME THE FIFTH.

EDITED BY

J. EWING MEARS, M.D.,

RECORDER OF THE ASSOCIATION.

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OFFICERS

OF THE

AMERICAN SURGICAL ASSOCIATION.

Elected at the Meeting, May 14, 1887.

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VICE-PRESIDENTS.

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LIST OF THE PRESIDENTS

OF THE

ASSOCIATION FROM THE TIME OF ITS INSTITUTION.

ELECTED

1880. SAMUEL DAVID GROSS, M.D., LL.D., D.C.L. Oxon., LL.D. Cantab., LL.D. Edin.—Founder of the Association.

1883. EDWARD MOTT MOORE, M.D., LL.D.

1884. WILLIAM THOMPSON BRIGGS, M.D.

1885. MOSES GUNN, A.M., M.D., LL.D.

1886. HUNTER McGUIRE, M.D.

1887. D. HAYES AGNEW, M.D., LL.D.

FELLOWS

OF THE

AMERICAN SURGICAL ASSOCIATION.

MAY, 1887.

* Denotes Original Members.
† Denotes Fellows who have resigned.
‡ Denotes Fellows who are deceased.

ELECTED

1882. AGNEW, D. HAYES, M.D., LL.D., *President*, 1611 Chestnut Street, Philadelphia. Professor of Surgery and of Clinical Surgery in the University of Pennsylvania, Surgeon to the Pennsylvania Hospital, to the University Hospital, and Consulting Surgeon to the Orthopædic Hospital, Philadelphia.

*1880. ASHHURST, JOHN, Jr., M.D., 2000 West De Lancey Place, Philadelphia. Professor of Clinical Surgery in the University of Pennsylvania, Surgeon to the Pennsylvania Hospital, Senior Surgeon to the Children's Hospital of Philadelphia.

1882. BARTON, JAMES M., A.M., M.D., 1344 Spruce Street, Philadelphia. Surgeon to the Jefferson Medical College Hospital, and to the German Hospital, Philadelphia.

*1880. BENHAM, SILAS NELSON, A.M., M.D., 156 Third Avenue, Pittsburg, Pa.

1882. BILLINGS, JOHN SHAW, M.D., LL.D. Edin., Surgeon-General's Office, Washington. Surgeon U. S. Army. *Member of Council*, 1884–87.

ELECTED

1882. Bontecou, Reed Brockway, M.D., 82 Fourth Street, Troy, N. Y. Surgeon to Marshall Infirmary of Troy.

†1882. Bozeman, Nathan, M.D., New York.

*1880. Bramble, D. D., M.D., 169 Broadway, Cincinnati, Ohio.

*1880. Briggs, William Thompson, M.D., corner Summer and Union Streets, Nashville, Tenn. Professor of Surgery in the Medical Department of the University of Nashville and Vanderbilt University, Surgeon to the University Hospital of Nashville. *President*, 1884.

*1880. Brinton, John H., M.D., 1423 Spruce Street, Philadelphia. Professor of the Practice of Surgery and of Clinical Surgery in the Jefferson Medical College of Philadelphia, Surgeon to St. Joseph's Hospital of Philadelphia. *Treasurer*, 1884–1885.

1882. Bull, William Tillinghast, M.D., 35 West Thirty-fifth Street, New York. Surgeon to the New York Hospital, to Chambers Street Hospital, Consulting Surgeon to St. Luke's Hospital and to the Hospital for Ruptured and Crippled, New York.

‡*1880. Byrd, William Andrew, M.D., 416 Jersey Street, Quincy, Ill. Professor of Clinical Surgery in the Quincy College of Medicine, Consulting Surgeon to the Sarah Denman Hospital, Quincy, Ill.

*1880. Cabell, James L., A.M., M.D., LL.D., University of Virginia, Virginia. Professor of Surgery in the University of Virginia.

*1880. Campbell, Henry Fraser, A.M., M.D., Augusta, Ga. Professor of Surgery and Gynecology in the Medical Department of the University of Georgia, Surgeon to the City Hospital and to the Freedman's Hospital of Augusta, Ga. *Member of Council*, 1882.

1885. Carmalt, William H., A.M., M.D., 87 Elm Street, New Haven, Connecticut. Professor of Surgery in Yale College, Surgeon to the New Haven Hospital.

ELECTED

1882. CHEEVER, DAVID WILLIAMS, M.D., 239 Boylston Street, Boston. Professor of Surgery in Harvard University, Surgeon to the Boston City Hospital.

*1880. COLEMAN, JOHN SCOTT, M.D., 563 Green Street, Augusta, Georgia.

1882. COMINGER, JOHN A., M.D., 77½ South Illinois Street, Indianapolis, Ind. Professor of Surgery in the Indiana Medical College, Surgeon to the City Hospital of Indianapolis.

*1880. CONNOR, PHINEAS SANBORN, M.D., LL.D., *Treasurer*, 159 West Ninth Street, Cincinnati, Ohio. Professor of Surgery in the Medical College of Ohio, Surgeon to the Cincinnati Hospital and to the Good Samaritan Hospital, Cincinnati. *Member of Council*, 1883.

1883. DANDRIDGE, NATHANIEL PENDLETON, M.D., 63 W. Eighth Street, Cincinnati, Ohio. Professor of Genito-urinary Diseases in Miami Medical College, Surgeon to the Cincinnati Hospital and to the Episcopal Hospital for Children, Cincinnati.

*1880. DAVIS, SAMUEL T , M.D., 134 North Fourth Street, Lancaster, Pa.

*1880. DAWSON, WILLIAM WIRT, M.D., corner Third and Broadway, Cincinnati, Ohio. Professor of Clinical Surgery in the Medical College of Ohio, Surgeon to the Hospital of the Good Samaritan, Cincinnati. *Vice-President*, 1883.

1882. DENNIS FREDERIC SHEPARD, M.D., *Vice-President*, 21 East Twenty-first Street, New York. Professor of the Principles and Practice of Surgery in the Bellevue Hospital Medical College, Surgeon to the Bellevue Hospital, to St. Vincent's Hospital, and Consulting Surgeon to the Hospital for Ruptured and Crippled, New York.

1882. DETMOLD, WILLIAM, M.D., 38 East Ninth Street, New York. Professor of Military and Clinical Surgery in the College of Physicians and Surgeons of Columbia College (Emeritus), Consulting Surgeon to the Presbyterian Hospital of New York.

ELECTED

‡*1880. DUGAS, LOUIS ALEXANDER, M.D., LL.D., Augusta, Ga. *Vice-President*, 1881.

1882. DUNOIT, THOMAS J., M.D., 132 Walnut Street, Harrisburg, Pa. Surgeon to the Harrisburg Hospital.

1883. FENGER, CHRISTIAN, M.D., 214 East Ohio Street, Chicago. Professor of General Pathology and Pathlogical Anatomy in the Chicago Medical College (Medical Department of Northwestern University).

1882. FORBES, WILLIAM SMITH, M.D., 1409 Locust Street, Philadelphia. Professor of Anatomy in the Jefferson Medical College of Philadelphia, Surgeon to the Protestant Episcopal Hospital of Philadelphia.

1882. GAY, GEORGE WASHINGTON, M.D., 589 Tremont Street, Boston. Surgeon to the Boston City Hospital. *Member of Council*, 1882.

*1880. GOULEY, JOHN W. S., M.D., 134 Madison Avenue, New York. Surgeon to Bellevue Hospital, New York. *Member of Council*, 1881; *Vice-President*, 1886.

1882. GREGORY, ELISHA H., M.D., LL.D., 1006 Olive Street, St. Louis. Professor of Surgery in the St. Louis Medical College, Surgeon to the St. Louis Hospital, St. Louis. *Vice-President*, 1884.

‡*1880. GROSS, SAMUEL DAVID, M.D., LL.D., D.C.L. Oxon., LL.D. Cantab. LL.D. Edin., LL.D. Univ. Penna., Philadelphia. *Founder*, and *President* 1880, 1881, 1882.

*1880. GROSS, SAMUEL W., A.M., M.D., 1112 Walnut Street, Philadelphia. Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College of Philadelphia.

‡*1880. GUNN, MOSES, A.M., M.D., LL.D., 2101 Calumet Avenue, Chicago. Professor of Surgery in Rush Medical College, Surgeon to St. Joseph's Hospital, Chicago. *Member of Council*, 1880, 1886; *Vice-President*, 1882; *President*, 1885.

†*1880. HUTCHISON, J. C., M.D., Brooklyn, N. Y.

ELECTED

1882. ISHAM, RALPH N., A.M., M.D., 321 Dearborn Avenue, Chicago. Professor of the Principles and Practice of Surgery in the Chicago Medical College (Medical Department of the Northwestern University).

*1880. JOHNSTON, CHRISTOPHER, M.D., Baltimore. Professor of Surgery in the University of Maryland (Emeritus). *Vice-President*, 1885.

*1880. KEEN, WILLIAM WILLIAMS, A.M., M.D., 1729 Chestnut Street, Philadelphia. Professor of the Principles and Practice of Surgery in the Woman's Medical College of Philadelphia, Surgeon to St. Mary's Hospital of Philadelphia.

*1880. KINLOCH, ROBERT ALEXANDER, M.D., 285 Meeting Street, Charleston. Professor of Surgery in the Medical College of the State of South Carolina, Surgeon to the Roper Hospital, to the City Hospital, and Surgeon and Gynecologist to St. Xavier's Infirmary, Charleston. *Member of Council*, 1880–81, 1886.

*1880. LEVIS, RICHARD J., A.M., M.D., Northwest corner Walnut and Sixteenth Streets, Philadelphia. Surgeon to the Pennsylvania Hospital and to the Jefferson College Hospital, Philadelphia.

*1880. MARKS, SOLON, M.D, 136 Wisconsin Street, Milwaukee, Wisconsin. Surgeon to St. Mary's Hospital of Milwaukee.

*1880. MASTIN, CLAUDIUS HENRY, M.D., LL.D., Northeast corner Joachim and Conti Streets, Mobile, Ala. Surgeon to the Providence Infirmary, Mobile, Ala. *Vice-President*, 1883.

1887. MASTIN, WILLIAM MCDOWELL, M.D., Northeast corner Joachim and Conti Streets, Mobile, Ala.

1883. MCCANN, JAMES, M.D., 300 Penn Avenue, Pittsburg. Surgeon to the Western Pennsylvania Hospital, Pittsburg, Pa.

1882. MCGRAW, THEODORE A., M.D., 107 West Fort Street, Detroit, Michigan. Professor of Surgery in the Detroit Medical College, Surgeon to St. Mary's Hospital and to the Harper Hospital, Detroit.

ELECTED

*1880. McGuire, Hunter, M.D., 513 Grace Street, Richmond, Va. *Member of Council*, 1880–85; *President*, 1886.

1882. Maclean, Donald, M.D., F.R.C.S. Edin., 72 Lafayette Avenue, Detroit, Michigan. Fellow of the Royal College of Physicians and Surgeons, Kingston, Ontario; Professor of Surgery and of Clinical Surgery in the University of Michigan; Surgeon to the University Hospital, Ann Arbor; Consulting Surgeon to the Harper Hospital, Detroit.

1882. McLean, LeRoy, M.D., 21 First Street, Troy, New York. Surgeon to the Troy Hospital in charge of the Sisters of Charity.

*1880. Mears, J. Ewing, A.M., M.D., 1429 Walnut Street, Philadelphia. Professor of Anatomy and of Clinical Surgery in the Pennsylvania College of Dental Surgery, Demonstrator of Surgery in the Jefferson Medical College of Philadelphia, Surgeon to St. Mary's Hospital, Philadelphia. *Recorder*, 1881–87.

1885. Michael, Jacob Edwin, A.M., M.D., 246 Madison Avenue, Baltimore. Professor of Anatomy and Clinical Surgery in the University of Maryland, Surgeon to the University Hospital, Consulting Surgeon to the Presbyterian Eye, Ear, and Throat Charity Hospital, Baltimore.

*1880. Moore, Edward Mott, M.D., LL.D., 63 South Fitzhugh Street, Rochester, N. Y. Surgeon to St. Mary's Hospital of Rochester. *Vice-President*, 1882; *President*, 1884.

*1880. Morton, Thomas George, M.D., Philadelphia. Surgeon to the Pennsylvania Hospital, to the Orthopædic Hospital, and to the Jewish Hospital, Philadelphia.

1886. Mudd, H. H., M.D., 500 N. Jefferson Avenue, St. Louis, Mo.

1882. Nancrede, Charles Beylard, M.D., 2109 Pine Street, Philadelphia. Professor of General and Orthopædic Surgery in the Philadelphia Polyclinic and College for Graduates, Surgeon to the Protestant Episcopal Hospital and to St. Christopher's Hospital for Children, Philadelphia.

ELECTED

1882. NORRIS, BASIL, M.D., Surgeon U. S. Army, Vancouver Barracks, Department of the Columbia, Washington Territory.

1882. OWENS, JOHN E., M.D., 1806 Michigan Avenue, Chicago. Professor of Surgical Anatomy and Operative Surgery in the Chicago Medical College, Attending Surgeon to St. Luke's Hospital of Chicago.

*1880. PACKARD, JOHN H., M.D., 1437 Spruce Street, Philadelphia. Surgeon to the Pennsylvania Hospital and to St. Joseph's Hospital, Philadelphia. *Treasurer*, 1880–83.

*1880. PANCOAST, WILLIAM HENRY, M.D., 1500 Walnut Street, Philadelphia. Professor of Anatomy in the Medico-Chirurgical College of Philadelphia.

1885. PARK, ROSWELL, A.M., M.D., 305 Delaware Street, Buffalo, New York. Professor of Surgery in the Medical Department of the University of Buffalo, Surgeon to the Buffalo General Hospital.

1882. PARKES, CHARLES T., M.D., 125 State Street, Chicago. Professor of Anatomy in Rush Medical College, Surgeon to the Presbyterian Hospital, Physician-in-Charge of St. Joseph's Hospital, Chicago.

1883. PECK, WASHINGTON F., A.M., M.D., 110 East Third Street, Davenport, Iowa. Professor of Surgery and of Clinical Surgery in the Medical Department of the State University of Iowa, Surgeon to the Mercy Hospital of Davenport, and Consulting Surgeon to the Mercy Hospital of Iowa City.

1881. POLLOCK, ALEX. M., M.D., P. O. Box 838, Pittsburg, Pa. Surgeon to the Mercy Hospital and to the Passavant's Hospital of Pittsburg.

1887. PORTER, CHARLES BURNHAM, A.B., A.M., M.D. (Harv.), 5 Arlington Street, Boston, Mass. Professor of Clinical Surgery in Harvard Medical School.

1882. PORTER, WILLIAM GIBBS, M.D., 1223 Spruce Street, Philadelphia. Surgeon to the Presbyterian Hospital and to the Philadelphia Hospital.

ELECTED

1882. PREWITT, THEODORE F., M.D., 2126 Olive Street, St. Louis. Professor of the Principles and Practice of Surgery and of Clinical Surgery in the Missouri Medical College, Surgeon to St. John's Hospital, St. Louis. *Vice-President*, 1886.

1882. PRINCE, DAVID, M.D., Jacksonville, Illinois.

1886. RANSOHOFF, JOSEPH, M.D., 296 Walnut Street, Cincinnati, Ohio. Professor of Anatomy in the Medical College of Ohio.

1882. REED, THOMAS B., M.D., 1427 Walnut Street, Philadelphia. Surgeon to the Presbyterian Hospital, Philadelphia.

1887. RICHARDSON, MAURICE HOWE, A.B., M.D. (Harv.), 66 Beacon Street, Boston, Mass. Surgeon to the Massachusetts General Hospital, Surgeon to the Carney Hospital, Demonstrator of Anatomy in Harvard Medical School, and Assistant in Surgery in Harvard Medical School.

*1880. RICHARDSON, TOBIAS G., M.D., 282 Prytania Street, New Orleans. Professor of Surgery in the Medical Department of the University of Louisiana, Surgeon to the Charity Hospital, New Orleans.

1882. ROBERTS, JOHN B., M.D., 1118 Arch Street, Philadelphia. Professor of Applied Anatomy and of Operative Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine, Surgeon to St. Mary's Hospital of Philadelphia.

1882. RUSHMORE, JOHN DIKEMAN, M.D., 129 Montague Street, Brooklyn, N. Y. Professor of Surgery in the Long Island College Hospital, Surgeon to the Brooklyn Hospital, to St. Peter's Hospital, and to the Eye and Ear Hospital, Brooklyn.

*1880. RUSSELL, THOMAS PEMBER, M.D., Oshkosh, Wisconsin.

1882. SABINE, THOMAS TAUNTON, M.D., 8 East Twenty-fourth Street, New York. Professor of Anatomy in the College of Physicians and Surgeons, New York.

ELECTED

*1880. SAYRE, LEWIS ALBERT, M.D., 285 Fifth Avenue, New York. Professor of Orthopœdic Surgery in the Bellevue Hospital Medical College, Consulting Surgeon to the Bellevue Hospital, to the Charity Hospital, to St. Elizabeth's Hospital, and to the Home for Incurables, New York.

1882. SENN, NICHOLAS, M.D., *Vice-President*, 523 Twelfth Street, Milwaukee, Wis. Surgeon to the Milwaukee Hospital.

1882. SMITH, ALAN PENNIMAN, M.D., 45 Franklin Street, Baltimore, Md. Surgeon to St. Vincent's Hospital, to the Union Protestant Infirmary, to the Hebrew Hospital, to St. Agnes's Hospital, to the Maryland Eye, Ear, and Throat Hospital, and to the Hospital for Diseases of Women, Baltimore, Maryland.

1882. SMITH, STEPHEN, A.M., M.D., 31 West Forty-second Street, New York. Professor of Clinical Surgery in the University Medical College of New York, Surgeon to Bellevue Hospital and to St. Vincent's Hospital, New York.

1882. SQUIRE, T. H., M.D., 409 East Church Street, Elmira, N. Y.

1883. TAYLOR, WILLIAM EDWIN, M.D., "Occidental Hotel," San Francisco, Cal. Professor of the Principles and Practice of Surgery in the Medical Department of the University of California, and in the Dental Department of the same University, San Francisco.

1882. THOMSON, WILLIAM, M.D., 1502 Locust Street, Philadelphia. Honorary Professor of Ophthalmology in the Jefferson Medical College of Philadelphia, Ophthalmic Surgeon to the Jefferson Medical College Hospital, Philadelphia.

1885. THOMPSON, J. FORD, M.D., 1401 H. Street, N. W., Washington, D. C. Professor of Surgery in the National Medical College, Surgeon to the Garfield Memorial Hospital and to the Children's Hospital.

ELECTED

1882. TIFFANY, LOUIS MCLANE, A.M. Cantab., M.D., 137 Park Avenue, Baltimore. Professor of Surgery in the University of Maryland, Surgeon to the University Hospital, Baltimore. *Member of Council*, 1885–87.

*1880. TREMAINE, WILLIAM S., M.D., Buffalo, N. Y. Major and Surgeon U. S. Army, Professor of Surgery in the Niagara University of Buffalo, N. Y., Surgeon to the Buffalo Hospital of Sisters of Charity, Buffalo, N. Y.

1882. VANDERVEER, ALBERT, A.M., M.D., Ph.D., 28 Eagle Street, Albany, N. Y. Professor of Surgery and Clinical Surgery in the Albany Medical College, Consulting Surgeon to St. Peter's Hospital, and Attending Surgeon to the Albany Hospital.

1885. VARICK, THEODORE R., M.D., 239 Washington Street, Jersey City, N. J. Surgeon to St. Francis's Hospital and to Jersey City Charity Hospital.

†*1880. WALES, P. S., M.D., Surgeon U. S. N., Washington, D. C.

1882. WARREN, JOHN COLLINS, M.D., 58 Beacon Street, Boston. Assistant Professor of Surgery in Harvard University, Surgeon to the Massachusetts General Hospital, Boston.

1882. WATSON, B.A., A.M., M.D., 124 York Street, Jersey City, N. J. Surgeon to the Jersey City Charity Hospital, to St. Francis's Hospital, and to Christ's Hospital.

*1880. WEIST, JACOB ROWLAND, A.M., M.D., 118 North Eighth Street, Richmond, Ind. Surgeon to St. Stephen's Hospital, Richmond, Ind. *Secretary*, 1880–85.

*1880. WESTMORELAND, W. F., M.D., 55 Marietta Street, Atlanta, Ga.

1882. WHITE, J. WILLIAM, M.D., Ph.D., 1810 S. Rittenhouse Square, Philadelphia. Demonstrator of Surgery, Lecturer on Operative and Minor Surgery, Lecturer on Genito-urinary and Venereal Diseases in the University of Pennsylvania, Surgeon to the Philadelphia Hospital, and Assistant Surgeon to the University Hospital, Philadelphia.

ELECTED

1882. WILLARD, DEFOREST, M.D., Ph.D., 1818 Chestnut Street, Philadelphia. Lecturer on Orthopædic Surgery in the University of Pennsylvania, Surgeon to the Presbyterian Hospital, and Consulting Surgeon to the Home for Cripples, Philadelphia.

*1880. YANDELL, DAVID W., M.D., Louisville, Ky. Professor of the Principles of Surgery and of Clinical Surgery in the Medical Department of the University of Louisville.

HONORARY FELLOWS.

ELECTED

1885. ANNANDALE, THOMAS, Regius Professor of Clinical Surgery in the University of Edinburgh.

‡1882. ATLEE, JOHN L., M.D., LL.D., Lancaster, Pa.

1886. BIGELOW, HENRY J., M.D., 52 Beacon Street, Boston, Mass.

1885. BILLROTH, THEODOR, M.D., Professor of Surgery in the University of Vienna.

1885. CZERNY, VINCENZ, M.D., Professor of Surgery in the University of Heidelberg.

1885. ERICHSEN, JOHN ERIC, LL.D., Emeritus Professor of Surgery in University College, London.

1885. ESMARCH, FRIEDRICH, M.D., Professor of Surgery in the University of Kiel.

1882. HORWITZ, P. J., M.D., Medical Director U. S. Navy, Philadelphia.

1882. HUNT, WILLIAM, M.D., Surgeon to the Pennsylvania Hospital, Philadelphia.

‡1886. LANGENBECK, VON, PROF. DR. BERNHARD, 54 Kappellen Strasse, Weisbaden, Germany.

1885. LISTER, Sir JOSEPH, Bart., D.C.L., LL.D., Professor of Clinical Surgery in King's College, London.

1887. OLLIER, PROF. DR. LEOPOLD, 3 Quai de la Charite, Lyons, France.

ELECTED

1886. MacCormac, Sir William, Bart., 13 Harley Square, London, W.

1885. Nussbaum, Dr. V., Professor of Surgery in Munich.

1885. Paget, Sir James, Bart., D.C.L., LL.D., London.

1885. Verneuil, A., M.D., Professor of Clinical Surgery at the Faculty of Medicine of Paris.

1885. Volkmann, Richard, M.D., Professor of Surgery at the University of Halle.

CONTENTS.

PAGE

Officers of the Association iii
List of the Presidents of the Association iv
Fellows of the Association v
Honorary Fellows xvii
List of Illustrations xxi
Notice xxii
Remarks by Dr. D. Hayes Agnew on His Election as President . xxiii

Address of the President. The Need and Value of Coöperative Work in Surgery. By HUNTER MCGUIRE, M.D., of Richmond, Virginia 1
Suprapubic Cystotomy. Its Technique Illustrated by Anatomical Preparations. By FREDERIC S. DENNIS, M.D., Professor of Surgery in Bellevue Hospital Medical College, New York . . . 9
Suprapubic Cystotomy for Purposes other than the Extraction of Calculus. By JOHN H. PACKARD, A.M., M.D., Surgeon to the Pennsylvania Hospital and to St. Joseph's Hospital, Philadelphia . . 29
To What Extent can we Classify Vesical Calculi for Operation? With a Report of Cases and Remarks on the Different Methods Employed. By A. VANDERVEER, M.D., of Albany, New York . 79
The Process of Repair after Resection of the Intestine and Intestinal Suture. By J. COLLINS WARREN, M.D., of Boston, Mass. . . 141
Should Laparotomy be done for Penetrating Gunshot Wounds of the Abdomen Involving the Viscera? By CHARLES B. NANCREDE, M.D., of Philadelphia; Professor of General and Orthopædic Surgery in the Philadelphia Polyclinic; Senior Surgeon to the Protestant Episcopal Hospital and to St. Christopher's Hospital for Children 155
Pistol-shot Wound of Abdomen treated by Laparotomy and Suturing the Intestines. By R. A KINLOCH, M.D., of Charleston, S. C. . 183

PAGE

Pistol-shot Wound of the Abdomen, Involving the Liver, Stomach, Superior Mesenteric Artery and Vein, Small Intestine, and Kidney: Laparotomy; Nephrectomy; Death on the Fifteenth Day; Autopsy. By W. W. KEEN, M.D., Professor of Surgery in the Woman's Medical College of Penna., Surgeon to St. Mary's Hospital, etc. . 193

Report of a Case of Ventral Hernia Successfully Treated by Operation, with a Suggestion as to the Method of Operating. By J. EDWIN MICHAEL, M.A., M.D., Professor of Anatomy and Clinical Surgery in the University of Maryland 227

The Prognosis of Sarcomata of the Breast. By SAMUEL W. GROSS, M.D., LL.D., Professor of the Principles of Surgery and Clinical Surgery in the Jefferson Medical College of Philadelphia . . 233

Medico-Legal Aspects of Cranial and Heart Wounds. By D. HAYES AGNEW, M.D., Professor of Surgery in the University of Pennsylvania 243

Comparison Between the Surgical Diseases of the White and Colored Races. By LOUIS MCLANE TIFFANY, M.D., Professor of Surgery in the University of Maryland 261

An Experimental Study of the Effects of Puncture of the Heart in Cases of Chloroform Narcosis. By B. A. WATSON, A.M., M.D., Surgeon to Charity, St. Francis, and Christ Hospitals, Jersey City, N. J. 275

Some Remarks on Hypertrophy of the Tongue, Otherwise Known as Lingua Vituli, Lingua Propendulæ, and Macroglossia. By T. J. DUNOTT, M.D., of Harrisburg 311

Vaginal Hysterectomy. By J. FORD THOMPSON, M.D., of Washington, D. D. 323

Synopsis of the Treatment of a Case of Aneurism of the Left Subclavian Artery, in which Three Methods were Successfully Employed; Followed by Death. By T. G. RICHARDSON, M.D., Professor of Surgery in the Medical Department of Tulane University of Louisiana, New Orleans 341

A Femoral Aneurism Cured by Elevation and Flexion of the Limb. By T. G. RICHARDSON, M.D., Professor of Surgery in the Medical Department of Tulane University of Louisiana, New Orleans . 345

Wounds, their Aseptic and Antiseptic Management. By DAVID PRINCE, M.D., of Jacksonville, Ill. 349

Splenectomy for Dislocated or Wandering Spleen. By JAMES MCCANN, M.D., of Pittsburg, Pa.; Surgeon to the Western Pennsylvania Hospital; Professor of Surgery, Western Pennsylvania Medical College 365

A New Kolpoplastic Operation for Atresia or Defect of the Vagina. By CHRISTIAN FENGER, M.D., of Chicago, Ill. 375

LIST OF ILLUSTRATIONS.

PAGE

The Process of Repair after Resection of the Intestinal Suture. Figs. 1–3. (J. COLLINS WARREN, M.D.) 145–149

Pistol-shot Wound of the Abdomen. Figs. 1–5. (W. W. KEEN, M.D.) 194–202

Comparison between the Surgical Diseases of the White and Colored Races. Plate showing Keloid in the Negro. (LOUIS MCLANE TIFFANY, M.D.) . . . . . *facing* 263

Synopsis of the Treatment of a Case of Aneurism of the Left Subclavian Artery. (T. G. RICHARDSON, M.D.) 342

A Femoral Aneurism Cured by Elevation and Flexion of the Limb. (T. G. RICHARDSON, M.D.) 346

Wounds, their Aseptic and Antiseptic Management. (DAVID PRINCE, M.D.) 355

A New Kolpoplastic Operation for Atresia or Defect of the Vagina. Figs. 1, 2. (CHRISTIAN FENGER, M.D.) 377, 381

NOTICE.

THIS Volume of TRANSACTIONS contains the papers read before the Association at the meeting held May 11, 12, 13, and 14, 1887.

The Association assumes no responsibility for the statements and opinions published in this volume.

REMARKS BY DR. D. HAYES AGNEW ON HIS ELECTION AS PRESIDENT.

I CONFESS that this announcement is to me one of regret as well as surprise and pleasure. Regret, because when I look over this distinguished body of men, of representative men, I see many who would discharge the duties of this office with more dignity and more efficiently than I shall be able to do. I have never been an office-holder and never wanted to be. Pleasure, again, because it is no small honor to preside over a body of distinguished men like yourselves. I accept the office not so much for the honor, but because it comes unsolicited, and conveys to me the good wishes and the good feeling of a body of men whom I love.

ADDRESS OF THE PRESIDENT.

THE NEED AND VALUE OF COÖPERATIVE WORK IN SURGERY.

BY HUNTER McGUIRE, M.D.,
OF RICHMOND, VIRGINIA.

GENTLEMEN: To preside over a body of men each one of whom is daily, almost hourly, doing something to lessen human suffering, and to add to the life and comfort of his fellow-man, is, indeed, a proud distinction. It would be useless for me, however, to attempt to conceal the embarrassment I feel in occupying the position to which you have called me to-day. When I see around me those who fill the high station which their attainments and services, no less than the just appreciation of the public, has given them, and especially when I remember the men who before me have filled this chair, and recall the philosophic and scientific addresses to which you have listened, I am equally impressed by the honor conferred upon me, by the consciousness of my own unworthiness of such a distinction, and by my inability to meet the requirements of such an office. The personal regard and partial kindness shown in making me your President, embolden me to ask your indulgence while I venture to occupy your time, briefly, not with a discussion of surgical subjects, for the programme shows how rich the supply of material will be in that direction, but with some remarks concerning the great need and value of coöperative work in our profession, and afterward in suggesting some changes in the management of the meetings of this Association.

That "In union there is strength," is a proverb recognized and accepted by all men. Nearly every advance accomplished by human enterprise is secured by coöperative effort. Thus agriculture is improved, laws perfected, philosophical investigations consummated, political and philanthropic reforms attained. Whatever most contributes to the wealth, power and stability of a nation is similarly ascertained and acquired: canals and railroads constructed, just and equitable laws enacted, civilization extended, tyranny and oppression overthrown, the gospel preached, and civil and religious liberty secured.

Every department of life is full of examples of the power of association in the accomplishment of great purposes, while the illustrations are almost as numerous of the failure of individuals to attain those ends, because they work unaided and alone. They may be conscious of great ability, they may be enthusiastic workers in the departments to which they have devoted themselves, but in the end they are disappointed, frequently become misanthropic, and complain that they are misunderstood and misrepresented, when the truth is, their failure is not due to envy or misconception, but to the fact that they overestimate their independent strength, and do not seek the companionship, the sympathy, and the coöperation of others.

If a mountain is to be tunnelled, a thousand men may sally forth with pick-axes and shovels, but if each man attacks the mountain at the place of his own selection, and works on his own plane, regardless of his fellow-laborers, nothing will be accomplished, while a small band, organized and directed by a skilful engineer, according to scientific methods, will soon open a track through the great obstruction, such as commerce requires.

When Maury constructed his "Wind and Current Charts," they were placed, we are told, in the hands of every navigator who would take them, so that the observations by as many persons, and in as many places as possible, might prove the truth of his statements and make navigation safe and profitable. The value of such combined research was quickly appreciated,

so that in a few years nearly every country in Europe, as well as our own, and some of the South American States, united in the system of concerted observation. Well did Maury say of it, "Rarely has such a sublime spectacle been presented to the scientific world. All nations agreeing in carrying out one system of philanthropic research with regard to the sea. Though they may be enemies in all else, here they are friends. Each ship that navigates the high sea with these charts, and blank log-books on board, may henceforth be regarded as a floating observatory, a temple of science."

The historical illustrations of the power of associated influence are simply innumerable. The Turk of the sixteenth century was not the "Sick-man" of the present day. On the contrary, he was strong and aggressive enough to threaten European civilization. His fleets and armies were more numerous than those of any other power on the globe, and, of course, more than a match for any one of them. It was only when the great league formed by the union of all the Christian governments of that continent, under the splendid management of Don John of Austria, then a youth of twenty-four, compacting the whole alliance into one entity, and wielding it with consummate wisdom and courage, that the brilliant sea fight of Lepanto, famous for all time, was accomplished, and the barbarism that menaced Europe averted.

It was through the Consolidated East India Company, originating in a trifling dispute between the English and Dutch about the price of pepper, that the British Empire in the East was established. It was through the coöperation of thirty-three sovereign States and scores of antagonistic Duchies, and the several Landgraviates, Margraviates, Principalities, and Palatinates, that the United German Empire was formed, presenting now the most thoroughly organized, compacted, and efficient power on the continent of Europe.

Like petty provincial States, without dignity or force, full of jealousies and rivalries, are the isolated individual men, who in the pride of self-reliance and self-sufficiency, contemn the aid and sympathy of their contemporaries: so, too, like a great

consolidated empire will any science become, when all of its sons, laying aside petty aims and discords, band together to win those triumphs over ignorance and imposture, and to secure that advance in useful knowledge, all along the line, which constitutes the noblest reward of any profession.

Such, gentlemen, are some of the illustrations I have taken leave to present of what has actually been accomplished by united effort in other departments of labor; and such, be assured, are the successes and triumphs which await us, if we, too, appreciate its value, and avail ourselves of its potent influence.

If the celebrated aphorism of Pliny be true, that "To live is to observe," then it is evident that the more observers there are in the field, all having their investigations directed to one end, the richer must be the discoveries which make professional life, in the largest sense of the word, worth living.

Advance in surgery can be more surely made by Associations such as ours, than by any individual efforts of man. The life of one man is too short, and his field of labor too narrow, for him alone to hope to settle many of the vexed problems in our science. The day has passed when the dictum of one man, no matter how exalted he may be, is received without question. The desire now is to know what the mass of thinking men in our profession believe, teach, and practise, and what is the result of the combined intelligence of the profession. Few discoveries of value have been obtained by the observations of one man; at the first glance they may thus appear, but, when critically examined, they will be seen to have been gradually accomplished, and are the outcome of the labor of many years, and of many patient workers. After a time some giant in the profession seizes upon the unarranged material supplied by these workers, groups, arranges it, and one of the mooted questions in surgery is solved.

The difficulties which beset us are very numerous, and at first sight almost insuperable. Disease presents problems difficult to determine. We cannot apply to the human machine the fixed rules by which inanimate bodies are governed. The result of the work of the surgeon in private houses and public

hospitals must be different. The result obtained by the military surgeon is something different from the work of the surgeon in time of peace. The subtle influence of social and moral conditions, of climate, season, individual and race peculiarity, the surroundings of the patient, have all to be considered in settling many questions and determining the value of many contributions.

Our patience is often taxed in other ways; we have to eliminate and get rid of the rubbish with which we are too often flooded by ignorant but ambitious contributors. Fortunately, the task is an easy one here. It is more difficult to know when to reject material presented by skilful but unscrupulous workers, who, to gratify their own personal vanity, make false returns of their labors. While these men mislead the younger, and do incalculable mischief, they are suspected from the beginning by the older and more experienced surgeons, and sooner or later are detected.

I have mentioned only a few of the difficulties by which we are surrounded. Their influence over the true man, the true surgeon, should be to make him more patient, inspire him with more zeal, and teach him more plainly the value of coöperative industry. The end in view is to save human life, and to lessen human suffering, and for this we can afford to be patient. We know that each succeeding generation will correct some errors of the past, and the truth be more and more nearly approached. Surgery has for its basis scientific researches, and depends for its progress on scientific observations. Acting in unison and in harmony without regard to personal aims or individual ambitions, but animated by the desire for the progress and development of surgery, and concentrating all of our power to this end, we have everything to encourage us to believe that the advance of surgery in the future will be more rapid than it has been in the past.

But we cannot as surgeons alone hope to determine many of the questions which must arise in our calling. We need and must accept the help of the biologist, the patient disclosures of the pathologist, and the work of the chemist; and I might add

that of every known science and art, for there is no science or art a knowledge of which the surgeon may not some day find of use; indeed, there is no calling which demands wider and more comprehensive information. For the developments yet awaiting us, we must be indebted to the contributions which every patient and conscientious laborer may bring to the common stock of ascertained knowledge, and we will accomplish this best by the cultivation of a broad and generous appreciation of each others work, from which every particle of envy at the success of others has been eliminated, by the hearty commendation we give to all who have enlarged the boundaries of surgical science, or who have improved its art.

The genius which can appreciate excellence in others, is the genius most likely to produce what is excellent itself. An elevation of the moral, as well as the scientific status of our profession is one of the duties we owe to ourselves and the world, and the oftener we meet together, the fewer the professional bickerings and jealousies; old friendships are confirmed, new ones made, and a greater tolerance, charity, and good-will prevail. Let us catch the spirit of that brave and noble passage of Thackeray, who, in speaking of Dickens, his great rival in the world of letters, says: "Thankfully I take my share of the feast which this gentle, generous, and charitable soul has contributed to the happiness of the world. I take and enjoy my share, and say a benediction for the meal."

Before concluding, I venture to make the following suggestions, the adoption of which, I believe, will conduce to the good of the Association.

1st. I recommend the formation of a "Business Committee," whose duties shall be to prepare for each meeting the business and scientific work of the Association. This Committee will relieve your President of some labor and responsibility which should not be imposed upon him.

At each annual session the "Business Committee" should select two general subjects, in surgery, for discussion at the next meeting. The morning session, of the first and second days of the annual meetings, to be devoted to the discussion of

these general surgical questions. Two Fellows, to be appointed by the "Business Committee," to prepare papers for each one of the subjects selected. Six Fellows selected to discuss the papers presented, and after this, any Fellow be allowed to speak on the subject. The papers presented and the discussions will go forth to the medical world as the expression of the surgical opinions of this country. Already the *Transactions* of the Association are much esteemed, and have a place in the libraries of most of the learned medical organizations in Europe, as well as in this country, and it is believed that their scientific value will be increased by the plan suggested. The afternoon, or evening session of the first and second day, and the whole of the third day could be devoted to the reports of cases and other business.

2d. I recommend that the address of the President shall not exceed half an hour in length; that the readers of papers shall be limited to the same period of time; that those who discuss papers shall not occupy more than fifteen minutes; that volunteer papers shall not exceed twenty minutes of our time. Unless some rules of this kind are adopted the aim and purpose of this Association cannot be accomplished.

3d. I venture to suggest the abrogation of Art. 9 of the Constitution. This will allow us to admit to Fellowship some men in this country who are really needed in the Association. While I believe in the rigid observance of the Code of Ethics of the American Medical Association, and the absolute necessity of its enforcement in that body, there is no need for it in our Association. The only Code we should have is scientific work.

4th. I respectfully urge favorable consideration and adoption of the report of your Committee in regard to the Congress of American Physicians and Surgeons.

5th. I wish to call attention to the great importance of strictly guarding entrance to the Association of new Fellows. I suggest amendment to the Constitution, providing that propositions for membership shall lie over for one year. The high standing of the Association will be preserved by using great care in this respect. Friendship, nepotism, or favoritism should not control

elections. The qualifications for Fellowship should be age, experience in surgical work, scientific attainments, and general culture.

But, Gentlemen, I shall not delay you longer from the real work of this body. The papers promised from the distinguished Fellows and the discussions to follow, will be practical in character, of great interest, and of far-reaching importance.

SUPRAPUBIC CYSTOTOMY.

Its Technique Illustrated by Anatomical Preparations.

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The revival of suprapubic cystotomy awakes great interest among surgeons throughout the civilized world. In former years the high operation was reserved for large calculi which could not be removed by any of the perineal operations. The rate of mortality was so high that the operation was considered justifiable only in extreme cases. At the present time, through the influence of the writings and demonstrations of Garson and Petersen, suprapubic cystotomy is likely to become a recognized operation for the removal of calculi of all sizes, and of all descriptions.

In addition to the removal of stone, the high operation has opened up a new field to the practical surgeon. Vesical tumors and ruptures of the bladder are now operated upon where heretofore no operations were performed. This great change in operative procedure has been brought about by anatomical demonstrations and by experimental work upon the cadaver. The results of these experiments have proved the safety of exploration of the bladder by the sectio alta. It is interesting to observe in this connection the different stages through which the operation has passed, from the earliest recorded dates down to the present time.

In studying the history of the operation in chronological order, one is forcibly impressed with the fact that the present complete and perfect method of performing epicystotomy is

not due to the entire work of any individual. The operation as it is now performed, according to the technique recommended by Garson and Petersen, has been the result of a gradual growth and steady development. The work of the anatomist has been supplemented by the surgeon. Practical applications have been made of knowledge obtained by experimental work upon the lower animals. Suprapubic cystotomy of the present century differs from the suprapubic cystotomy of the sixteenth century only in the perfection and completion of the details. The same general principles were formerly recognized, as I shall endeavor to point out, and it has been through the improvement of these different methods that the present complete operation has been perfected. In other words, improvements in the technique, rather than the introduction of any new principle, have given us this eminently satisfactory operation. I shall endeavor to prove that the suprapubic operation of to-day owes its parentage to the original operation.

In reading the early description of this operation, it is obvious that the great dangers were fully recognized, but the exact way in which to avert these dangers was not understood. The prevention of injury to the peritoneum and the avoidance of urinary infiltration, were aimed at in the early operations, but the means to bring about immunity from these special dangers were crude and undeveloped. In the modern high operation, the peritoneum is protected, and urinary infiltration avoided, by forcing the bladder upward by conjoined distention of the rectum and bladder. The additional safeguard to the danger of urinary infiltration, is offered by the employment of an antiseptic fluid for distending the bladder, instead of ordinary fluid. The principle of lifting the bladder upward was crudely demonstrated by the surgeon introducing his finger into the rectum and pushing up the bladder. The distention of the bladder was made by injecting fluid into the viscus. Hildanus, in the seventeenth century, recommended the use of the finger in the rectum for the purpose of lifting up the bladder. The accomplishment of this object is now secured by the use of the colpeurynter in the rectum, and by the injection of an antiseptic fluid into the

bladder. Douglas, Cheselden, and other surgeons, practised a certain amount of vesical distention. The principle recognized in the old and the new operation is identical, but the means employed to carry out the principle are widely different. Our forefathers have handed down to us a principle in the high operation which they fully recognized, and which they tried to carry into practice. They were unable to meet, practically, all the emergencies of the case. Our contemporaries have beautifully perfected and carried into execution the same principle by a method which to-day enables the surgeon to operate with comparative ease and safety.

A brief historical sketch of the suprapubic operation is pertinent, in order to appreciate the important changes through which this operation has passed. There is no authentic description of the suprapubic method until it was performed by Pierre Franco in the year 1561. Franco performed the operation upon a boy, but did not commend it to the profession. Rousset, in 1581, wrote a careful description of the operation, and highly commended it to the profession. Rousset's paper deals with the operation from a theoretical point of view, and King Henry promised him several criminals for experimental work, in order to demonstrate the operation in a practical way. The king died, and Rousset was unable to prove the value of his suggestion by any demonstration upon the live human body. The operation now fell into disuse until 1635, when Mercier advocated it in a thesis before the Faculty of Medicine in Paris. Bonnet performed the operation with success in 1681 at the Hotel Dieu. Proby, in 1694, explored the bladder by the high operation for the removal either of a calculus or a foreign body. Historians do not agree in their accounts as to the object of the operation. Such is the brief historical sketch of this formidable operation until John Douglas, of London, reported four successful cases in 1723. Cheselden, in this same year, published a paper upon the operation, and afterward became its great champion. In 1727 Douglas had performed the operation nine times, with but one death; and Cheselden six times, with but

one death. Thornill had twelve cases, and only two of them died. McGill had five cases.

At this epoch, when the results were comparatively brilliant, the introduction of the infrapubic operation caused the suprapubic operation to fall into disrepute; not on account of its failures, but owing to the great *éclat* with which the perineal operations were received. Cheselden improved and developed the perineal method of the monk Frère Jacques, who began his operations in 1695, and of Rau, the Holland surgeon, and Cheselden then became the champion of the perineal operation, as he had been of the high operation. The suprapubic method was but little practised until Frère Comes revived the operation, and in 1779 published a description of his own method of performing suprapubic lithotomy. He made an opening in the membranous portion of the urethra, through the perineum (boutonnière), for the purpose of introducing a sound with a stylet (sonde á dard) in order to pierce the bladder just behind the symphysis pubis.

Since the time of Frère Comes the suprapubic operation has been seldom employed, until the introduction and practical application of Garson's and Petersen's experiments. From its earliest history to 1851 Gunther could collect only 260 cases. From 1850 to 1879 there were but few cases reported. From 1879 to the present time the suprapubic operation has been performed by many surgeons, and with such uniform success as to attract the undivided attention of surgeons throughout the civilized world. Reports of the brilliant success which has attended this modified suprapubic operation come pouring in from every land, and the time has now arrived when the shackles which have hitherto trammelled this operation shall be thrown aside and the results critically examined in an impartial and honest spirit.

The prophetic words of Dr. Roberts, uttered at a former meeting of this distinguished Association, in which he stated "that within ten years the suprapubic operation will be the operation adopted for all cases of stone that are not treated by Bigelow's operation," are now almost realized. I would venture to remark that the time is not far distant when there will be but practically

two operations for stone in the bladder, the suprapubic lithotomy and lithotrity. If future experience demonstrates that a return of calculus occurs in a fair percentage of the cases after lithotrity from débris left behind, and that the mortality of the suprapubic is reduced to a figure equal to or less than perineal lithotomy, then suprapubic lithotomy, with its special advantages, will be the recognized operation in the majority of the cases. If it can be shown that the mortality in the suprapubic operation is due in great part to causes which may be prevented in these days of antiseptic surgery, there is no doubt as to the future of the operation. It is simple in its technique, safe in its execution, radical in its results, free from injury to the reproductive organs, curative in its application, and finally brilliant in its statistics. With all these advantages time will soon determine the place which this operation is destined to take among the recognized surgical operations. On the other hand, the many and serious accidents which follow the lateral operation are avoided.

The technique of the operation of opening the bladder by the suprapubic method is worthy of consideration. A few days previous to the operation the patient can be put upon a milk diet, and the day previous to the operation the bowels should be freely moved by a dose of castor-oil, and the morning of the operation an enema should be given, so as to empty the rectum for the introduction of the rubber bag. The hair should be shaved from the pubes and the parts should be thoroughly washed and scrubbed and irrigated with a solution of bichloride of mercury or carbolic acid. This ablution should be repeated at the time of the operation. The patient being fully under the influence of ether is prepared for the operation. The surgeon should first introduce the India-rubber bag into the rectum. The bag should be oiled and should be carried well up the rectum so as to be above the internal sphincter. Into the rubber bag are injected, slowly, twelve ounces of warm water; at least I would recommend this quantity as the standard, and from it the amount can be slightly increased or diminished according to individual circumstances. Instead of water, air can be used to inflate the bag, as suggested first by Milliot in 1875, at Lyons ;

but the water for obvious reasons is preferable. If the patient is a boy, instead of an adult, less than twelve ounces of warm water must be injected. The surgeon should bear in mind the danger of rupture of the rectum, especially in elderly people and young boys, and exercise judgment in regard to the proper quantity of water to be injected in any given case. Serious mischief has followed the careless use of the rubber bag during dilatation of the rectum. In one case, where eighteen ounces were used, the rectum was lacerated.

The next step in the preparation of the pelvic viscera for the suprapubic operation is the distention of the bladder. Here again the surgeon must be very cautious lest he inject too great a quantity of water. A silver catheter should be passed and all the urine drawn, and then into the empty bladder about half the quantity of water should be carefully injected that was used to distend the rectum. The quantity should be about six ounces; at least this amount might be taken as a safe standard and variations made according to individual circumstances. The liquid should be antiseptic, and the best is Thiersch's solution, which contains boro-salicylic acid. The solution should be slowly injected and the surgeon should notice the ascent of the bladder above the pubes. He should also observe the amount of resistance offered to his hand during the distention of the bladder. The same caution here is advised as during the dilatation of the rectum; because any undue force might rupture the bladder, as has happened in several experiments. An India-rubber tubing can be passed around the penis after the catheter has been removed, to prevent the escape of the antiseptic fluid which has just been injected for the purpose of distending the bladder. If the assistant's finger is placed over the open mouth of the silver catheter, or, better, a small plug into the end of the catheter, the escape of the fluid will be prevented, and the silver catheter will also serve as a guide to cut upon when the bladder is exposed. This use of the catheter avoids the necessity of withdrawing the instrument and of reintroducing another into the bladder to serve as a guide to cut upon after the viscus is exposed in the wound. The distention of the

bladder after dilatation of the rectum increases the distance nearly three inches between the symphysis pubis and the anterior cul-de-sac or pubo-vesical fold of the perineum. The membranous and prostatic portions of the urethra are stretched, as has been shown by Sir Henry Thompson.

The patient being placed upon his back, with his pelvis elevated so as to cause the abdominal viscera to gravitate toward the diaphragm, is now ready for the operation. The surgeon stands on the left side of the patient and makes an incision three to four inches in length from below, beginning at the pubes, and extending upward exactly in the median line of the body. The skin, fasciæ, and cellular tissue having been divided, the linea alba is now exposed. The surgeon cuts along the raphe upon a grooved director between the pyramidalis and recti muscles, dividing also the transversalis fasciæ. It sometimes happens that the pyramidalis muscle is exposed by cutting the sheath of the rectus instead of going exactly through the linea alba, and the operator must remember that there is no posterior sheath to the pyramidalis, but only the transversalis fascia. The fascia must now be carefully divided, and the surgeon next exposes a small space filled with fat and loose connective tissue. Before disturbing this tissue a retractor can be placed in the wound, and this retractor, which is made like an eye-speculum, holds the edges of the wound apart, and enables the surgeon to command a good view of the parts, and to work with greater facility. The use of the retractor suggested itself to me by its employment in the operation for tracheotomy, where I have found the eye-speculum of great help in holding open the wound while making the deep incisions in order to open the trachea.

The fingers of the surgeon should now be introduced into the wound where he can feel the distended bladder. The loose connective and fatty tissue overlying the bladder should be carefully separated with the handle of the scalpel, then the upper surface of the bladder is brought fully into view, with its veins and muscular fasciculi showing on the surface. The surgeon should carefully avoid tearing up the cellulo-adipose connective tissue between the pubes and the neck of the bladder, as this might

afford an opportunity for urinary infiltration. The point of the silver catheter can be felt within the bladder upon its anterior wall, and this can be relied upon as a guide.

If any uncertainty exists as to whether the peritoneum is out of danger, the surgeon should examine to see if there are two sliding surfaces lying over the beak of the catheter, and if there is a distinct transverse raphe over the summit of the bladder. If only the wall of the bladder is present, the surgeon can seize the viscus with two delicate tenacula, and having observed that all hemorrhage and oozing have ceased, open the bladder between the two tenacula and over the point of the catheter.

The walls of the bladder, especially the mucous membrane, are often very much hypertrophied, as a result of the irritation from the stone. The small opening in the bladder is now enlarged by a probe-pointed bistoury in the direction downward toward the symphysis pubis, but never below toward the neck of the bladder and urethra. This last incision would be fraught with great danger. If the object of the operation is the removal of a tumor requiring a free exposure of the interior of the bladder, a stitch is taken in the bladder wall on each side of the incision, and the wound held apart by the suture. The threads also prevent the dipping down of the bladder after the fluid has escaped. The index finger, first dipped into a warm antiseptic solution, is now carried into the bladder and the stone felt, and with the assistance of the other index finger carefully lifted out of the bladder. Instead of the fingers the lithotomy forceps can be employed. If the stone is very large, it can be crushed before removal. If there is any difficulty in seizing and removing the calculus, the rubber bag can be emptied and removed, and the index finger of the assistant introduced into the rectum, and the stone pushed upward so that the surgeon can easily grasp it.

The bladder can now be thoroughly washed out and a soft flexible rubber catheter introduced through the urethra for perineal drainage. The catheter must be removed in forty-eight hours, or its presence will excite a traumatic urethritis. This complication occurred in a case last winter, in which I left the catheter in the bladder too long. An interesting clinical fact in

connection with this case was the certainty of the diagnosis as to the traumatic and not specific origin of the discharge. Dr. Seymour Houghton, House Surgeon in Bellevue Hospital, examined very carefully the pus in the Carnegie Laboratory, under the microscope, for the presence of Neisser's gonococci; but the staining failed after many attempts to show the special germ of this disease. I have seen a boy of ten years and a girl of eight years and also a boy of six years, all affected with gonorrhœa. The first two patients denied any knowledge as to the origin of the trouble, but when the gonococci were found and they were directly charged with it, they confessed. This complication of a traumatic urethritis serves as an important lesson to remind the surgeon not to leave the catheter in over two days. The catheter in this case was left in four or six days, but was aseptically clean. It was a desire to incur no risks of infiltration on account of the unusual size of the wound in the bladder that induced me to allow the catheter to remain longer than it was necessary.

In this connection might be mentioned the subject of perineal drainage after the suprapubic operation. Some surgeons provide drainage through the perineum by making an opening to the membranous portion of the urethra (the boutonnière) for the purpose of introducing a drainage tube into the bladder by this opening. This seems an unnecessary procedure, for the urethra with a rubber catheter introduced into it, will provide a natural drainage without incurring all the risks incident to wounding the perineum and urethra. Such a procedure exposes the patient to an additional danger of urinary infiltration, and to the danger of the formation of a traumatic stricture and to hemorrhage; and possibly to additional danger of septic infection. The urethra is the natural channel through which to drain, and the opening above can also be used for antiseptic siphon drainage and irrigation, as suggested by Sir Joseph Lister. Hence the perineal incision is unnecessary; besides, it adds the mortality of the median operation to that of the suprapubic. The very object of the high operation is defeated when a perineal wound is made.

The patient should lie with his shoulders elevated, or upon his side, and in this way better drainage is thus secured. Trendelenburg recommends the abdominal position for drainage after the operation. When this is practicable it is a most excellent method to establish perfect drainage.

Another question in the technique of the operation is the management of the wound in the bladder. Here an honest diversity of opinion exists among surgeons, and it is an important point for discussion in connection with the high operation. From a careful research into the meagre literature of the suprapubic operation in its modified form, and also from a limited practical experience, I feel convinced that the bladder wound in the majority of cases should be left open. If the bladder in an adult is sewed the wound is most likely to reopen on account of the pathological condition of the bladder wall and the mucous membrane. In chronic cystitis there is thickening of the bladder wall and ulceration in the mucous membrane. A failure to secure primary union is quite likely to occur, and if the wound reopens the dangers of infiltration of urine and septicæmia are greatly increased. In twenty-five cases collected by Schmitz with a view to throwing light upon this point six of the patients died, which gives a mortality of twenty-four per cent., and in only four cases did primary intention follow. If the wound in the bladder is stitched a natural provision for drainage is sacrificed, and on account of the unhealthy condition of the mucous membrane from a chronic cystitis accompanied by thickening of the entire bladder wall the wound is not likely to heal by primary intention. The wound opens and sloughs occur, and the result is extremely unsatisfactory.

While condemning the practice of suturing the bladder wound after removal of a calculus, the same plan is not to be followed in certain other conditions. In rupture of the bladder, for example, the wound should be sewed, but here the conditions of the mucous membrane and the walls of the bladder are altogether different. Primary intention is more likely to be secured in such a case where it would be useless to try under other conditions. If the bladder wound after a high operation for stone is left open

to heal by granulation, or partially closed by sutures in case of a large opening, it will permit the surgeon to treat intelligently a chronic cystitis. The wound in the skin can be partially closed and a large rubber drainage tube introduced into the bladder. After a few days the urine will pass the natural way and any little overflow is cared for by the upper drainage tube.

In young children where suturing the bladder is likely to be followed by primary intention the difficulties of the operation are very great on account of the extreme thinness of the bladder wall and the small abdominal wound. An attempt to close the vesical wound therefore prolongs the operation unnecessarily, and should not be attempted unless the bladder is fairly healthy, and the patient is in good bodily condition at the time of the operation. Lembert's sutures in close apposition should be employed and the mucous coat must not be included. The bladder must be carefully manipulated during the sewing so as to prevent cellulitis. After the wound is stitched an injection of an antiseptic fluid should be carefully made into the bladder to ascertain if there is any leakage. If the bladder is properly sewed no permanent drainage is indicated, but the soft catheter can be passed several times during the first twenty-four hours after the operation, and occasionally after the first day, so as to prevent any distention. The wound heals by primary intention and this occupies only a short time.

The abdominal wound is also closed and a small drainage tube is inserted into the lower angle of the wound. Von Bergmann sutures the bladder and packs the abdominal wound with iodoform gauze for forty-eight hours and thus prevents suppuration. He then closes the abdominal wound in two days after removing the gauze. Schmitz (Langenbeck's *Archiv*, vol. xxxiii., 1886) reports thirty cases of suture of the bladder in children, with a mortality of nearly seven per cent. In the thirty cases of suture about half of these cases resulted in primary union of the wound. If children and adult cases are grouped, it is estimated that in two-thirds of the cases the bladder wound reopens.

A few days after the operation the patient can sit up in bed and an uninterrupted and speedy recovery should take place.

Prof. Annandale recommends the introduction of a lithotrite into the bladder in order to seize the stone and then to cut upon the lithotrite as a guide and remove the stone. A rubber catheter is introduced into the blades of the lithotrite through the abdominal wound and the instrument withdrawn with the rubber catheter. The drainage through the perineum and also in the wound above is the same as in the method already described.

The special indications for exploration of the bladder by the suprapubic method are found:

First. In cases of lithotomy for large hard calculi; also in lithotomy occurring in a patient suffering from paraplegia, a contracted pelvis, perineal tumors, encysted calculi, ankylosis of the hip, hemorrhoids, or great obesity.

Second. For the removal of certain foreign bodies, as hairpins, bodkin-needles, etc., for the treatment of chronic cystitis, and for the operation of calculi in the female.

Third. In lithotomy occurring in a patient with greatly enlarged prostate, or with fibroma of the prostate, or in calculi found in diverticula behind the prostate.

Fourth. For the excision of tumors of the bladder.

Fifth. For rupture of the bladder.

The special advantages which the suprapubic operation offers may be enumerated as follows:

First. The safe removal of large hard stones which cannot be removed by any of the other methods.

Second. The avoidance of perineal hemorrhage, of urinary infiltration, of perineal fistula, of laceration of the rectum and neck of bladder, the prevention of traumatic stricture and cystic hemorrhage. The avoidance of any interference with the genital apparatus.

Third. The prevention of a vesico-vaginal fistula in young women, or of permanent incontinence of urine in aged women.

Fourth. The safest operation in all forms of renal disease, and the only means of saving life in rupture of bladder.

Fifth. The tendency of recurrence of stone is less than by crushing.

Sixth. Its extreme simplicity, its present reduced rate of mor-

tality, its comparative freedom from danger during its execution, and its safety for the general surgeon in comparison with the perineal operations or lithotrity.

I have collected one hundred and twenty-four cases of the suprapubic operation for the removal of stone since 1879. I have collated all the cases that I could find in medical journals and some cases which have as yet never been published. The influence of antiseptics, and of the rectal rubber-bag together with vesical distention, is apparent when the cases are carefully examined. The death-rate until 1879 was high, since it reached the average of about twenty-five to thirty per cent., but owing to the experiments of Garson and Petersen that mortality has been greatly reduced.

There are one hundred and twenty-four cases. There are, *in toto*, eighteen deaths. This gives a gross mortality of about fourteen per cent. Of these eighteen deaths, the following seven can be, with justice, eliminated from the list in estimating the rate of mortality.

1. Belfield. Corrosive sublimate poisoning.

2. Briggs. Patient was moribund at the time of the operation, and was suffering from suppression of urine before the operation. The operation was performed against the advice of the surgeon, and at the special request of the mother of the child. The conditions were necessarily fatal before any attempt was made to remove the stone.

3. Küster. A median operation was first performed to extract a piece of catheter. He was unable to remove the foreign body, and then performed a suprapubic cystotomy.

4. Martin. Recovery from operation; but patient died three months afterward.

5. Roberts. Recovery from operation. Patient had a gastric ulcer, and died two months after from perforation of the stomach.

6. Rivington. Recovery from operation. Patient died three months after from diarrhœa and cystitis.

7. Terrillon. Patient died from bronchitis eight days after operation. Autopsy showed that the bladder was healthy—wound aseptic, and nearly healed.

No.	Operator.	Reference.	Result.
1	Ambrook,	Denver Med. Times, 1884.	Recovery.
2	Ambrook,	" " " "	"
3	Annandale,	British Med. Journal, 1886.	"
4	V. Bergmann,	Centralblatt für Chirurgie, 1884.	"
5	V. Bergmann,	" " " "	"
6	V. Bergmann,	" " " "	"
7	V. Bergmann,	" " " "	"
8	V. Bergmann,	" " " "	"
9	V. Bergmann,	" " " "	"
10	V. Bergmann,	" " " "	"
11	V. Bergmann,	" " " "	"
12	V. Bergmann,	" " " "	"
13	V. Bergmann,	" " " "	"
14	Belfield,	New York Medical Record, 1886.	Died, 36 days, corrosive sublimate poisoning.
15	Briggs,	Trans. Amer. Surg. Assoc., 1884.	Died within 36 hours, shock.
16	Bond,	Lancet, 1887.	Recovery.
17	Barwell,	British Medical Journal, 1886.	"
18	Collamore,	Toledo Med. and Surg. Journ., 1879.	"
19	Colson,	Lance , 1887.	Died within 24 hrs
20	Cullingsworth,	British Medical Journal, 1886	Recovery.
21	Cabot,	Boston Med. and Surg. Journ., 1886.	"
22	Craft,	Lancet, 1887.	"
23	Delassus,	Journ. d. Sci. Méd. de Lille, 1885.	"
24	Dennis,	Trans. Amer. Surg. Assoc., 1887.	"
25	Dien	Bull. et Mem. Soc., 1885.	"
26	De St. Germain,	Rev. Mens. d. Mal., etc., Paris, 1885.	"
27	Depres,	Bull. Méd. du Nord, etc., 1885.	"
28	Dupont,	Ann. des Mal. des Organ., 1883.	"
29	Echevarria,	Cron. Med. Quis., Habana, 1886.	"
30	Field,	Texas Courier Record, 1887.	"
31	Folet,	Bull. Méd. du Nord, Lille, 1886.	"
32	Godet,	Ann. des Mal. des Organ., 1885.	"
33	Golding-Bird,	British Medical Journal, 1887.	"
34	Gavin,	Boston Med. and Surg. Journ., 1886.	"
35	Guyon,	Ann. des Mal., etc., 1881.	Died.
36	Guyon,	" " " " "	Recovery.
37	Guyon,	" " " " 1882.	Died.
38	Guyon,	" " " " "	Recovery.
39	Guyon,	" " " " 1885.	"
40	Guyon,	" " " " 1882.	"
41	Gosselin,	Bull. de l'Acad. Méd., 1881.	"
42	Gosselin,	" " " "	Died.
43	Gerster,	New York Medical Journal, 1886.	Died, shock, 5 hrs.
44	Hume,	Lancet, 1887.	Recovery.
45	Hume,	" "	"
46	Hyatt,	North Carolina Med. Journ., 1883.	"
47	Hyatt,	" " " " "	"
48	Hernandez,	Cron. Med. Quis., Habana, 1885.	"
49	Jacobson,	British Medical Journal, 1886.	"
50	Jacobson,	" " " "	"

No.	Operator.	Reference.	Result.
51	Jacobson,	British Medical Journal, 1886.	Recovery.
52	Jacobson,	" " " "	"
53	Jobard,	France Méd., Paris, 1883.	"
54	Keyes,	Not yet published. Result given by Dr. Keyes, 1887.	"
55	Kuster,	Centralblatt fur Chirurgie, 1884.	Died, septicæmia; stone left in bladder.
56	Langenbeck,	Philadelphia Medical Times, 1882.	Died, septicæmia, in 10 days.
57	Lister,	British Medical Journal, 1881.	Recovery.
58	Lister,	" " " "	"
59	Le Dentu,	Gaz. Méd. de Paris, 1882.	"
60	Lourmeau,	Journ. Méd. de Bourdeaux, 1886.	Died.
61	Morrison,	British Medical Journal, 1886.	Died in 2 weeks, 3 stones, 1 size of cocoanut.
62	Monod,	Ann. des Mal. des Organ., 1883.	Recovery.
63	Monod,	" " " " " "	"
64	Monod,	" " " " " "	"
65	Monod,	" " " " " "	"
66	McGill,	Lancet, 1887.	"
67	McGill,	" "	"
68	McGill,	" "	"
69	McPhail,	New York Medical Record, 1885.	"
70	Martin,	Canada Practitioner, 1884.	Recovery; 6 calculi.
71	Martin,	" " "	Recovery; died in 3 mos. 25 calculi
72	Martin,	" " "	Recovery.
73	Martin,	" " "	Recovery; 2 inch stone.
74	Martin,	" " "	Recovery.
75	Martin,	" " "	Died, one week; wound healthy; no fever.
76	Martin,	" " "	Recovery.
77	Mount Profit,	Ann. des Mal. des Organ., 1885.	"
78	Malherbe,	" " " " " 1883.	"
79	McCormac,	Lancet, 1885.	"
80	Pye,	British Medical Journal, 1886.	"
81	Pye,	" " " "	"
82	Perine,	Ann. des Mal. des Organ, 1883.	"
83	Patterson,	Glasgow Medical Journal, 1882.	"
84	Pilcher,	New York Medical Journal, 1885.	"
85	Parker,	Lancet, 1886.	"
86	Rivington,	British Medical Journal, 1886.	Recovery; died in 3 mos. diarrhœa and cystitis.
87	Roberts,	Maryland Medical Journal, 1887.	Recovery; death 2 mos. later from perforation of stomach, gastric ulcer.

No	Operator.	Reference.	Result.
88	Robson,	British Medical Journal, 1886.	Recovery.
89	Robson,	" " " "	"
90	Rachel,	American Journ. Med. Sci., 1879.	"
91	Smith,	Lancet, 1886.	Recovery; 24½ oz.
92	Swain,	" 1880.	Recovery.
93	Schwartz,	Soc. de Chirurgie de Paris, 1883.	"
94	Servillon,	Ann. des Mal. des Organ., 1884.	Died in 8 days of bronchitis; wound healthy.
95	Tait,	Medical Press and Circular, 1884.	Recovery.
96	Thompson,	Monograph on Suprapubic Oper., 1886.	"
97	Thompson,	" " " " "	"
98	Thompson,	" " " " "	Died 8th day.
99	Thompson,	" " " " "	Recovery.
100	Thompson,	" " " " "	"
101	Thompson,	" " " " "	"
102	Thompson,	" " " " "	"
103	Terrillon,	Bull. et Mem. du Chirurg., 1885.	"
104	Tuffier,	Ann. des Mal. des Organ, 1883.	Died.
105	Tillaux,	" " " " " 1884.	Recovery.
106	Tremaine,	Trans. Amer. Surg. Assoc., 1884.	"
107	Tremaine,	" " " " "	"
108	Violani,	Raccoglitore Med. Forte, 1886.	"
109	Villeneuve,	Marsel. Medical Journal, 1883.	"
110	Van Gondewer,	Ann. des Mal. des Organ., 1884.	"
111	Van Gondewer,	" " " " " "	"
112	Van Gondewer,	" " " " " "	"
113	Van Gondewer,	" " " " " "	"
114	Van Gondewer,	" " " " " "	"
115	Van Gondewer,	" " " " " "	"
116	Van Gondewer,	" " " " " "	"
117	Van Gondewer,	" " " " " "	"
118	Van Gondewer,	" " " " " "	"
119	Van Gondewer,	" " " " " "	"
120	Van Gondewer,	" " " " " "	"
121	Van Gondewer,	" " " " " "	"
122	Van Gondewer,	" " " " " "	"
123	Van Gondewer,	" " " " " "	"
124	Zaucarol,	" " " " " 1885.	"

There are eleven deaths which can be directly ascribed to the operation itself. This gives one death in about eleven cases, or a mortality of about nine per cent., for the removal of stone by suprapubic cystotomy.

The mortality in the lateral operation, according to Sir Henry Thompson, is about one in every eight cases, or, in other words, over twelve per cent.

I am aware of the fact that objection may be raised to taking Sir Henry Thompson's statistics on lateral lithotomy; because

other surgeons have published better results. Their experience, however, is not so great, nor is their number so large. In Sir Henry Thompson's cases lateral lithotomy was reserved, as a rule, for cases unsuitable for crushing. I will quote the statistics of other surgeons before any comparison is made.

Freyer reports one hundred and forty-three cases, without a death. Zelt reports one hundred and six cases, with three deaths, or a rate of mortality less than three per cent. Werewkin reports one hundred and forty-seven cases, with a mortality of six per cent. Hensinger reports two hundred and twenty-two cases, with a mortality of nearly seven per cent. Ebermann reports a mortality of fourteen per cent. Skinnisen reports one hundred and fifty-four cases, with seven deaths, or a rate of mortality of about four and a half per cent.

This great difference in the mortality of the lateral operation affords room for much conjecture as to its cause.

In lithotrity Sir Henry Thompson's last statistics show a death-rate of about six per cent. The Norwich Hospital records show a death-rate of over ten per cent.

In litholapaxy Dr. Freyer reports one hundred and eight cases, with a death-rate of nearly four per cent.; Keegan fifty-eight cases, with two deaths, or a rate of mortality of about three and a half per cent. Gross collected one hundred and eighty cases, with four deaths, or a rate of mortality of about three per cent.

The rate of mortality for the suprapubic operation performed with its recent modifications compares favorably with perineal lithotomy, and also with litholapaxy, when the stone is over an ounce. In addition to a favorable comparison, in regard to the rate of mortality in litholapaxy in large stones, the important question of recurrence of calculi must not be forgotten. After crushing the recurrence is estimated at one in seven cases, while after lithotomy, one in twenty-five cases. This fact is one of very great importance in estimating the relative value of the two operations in any given case.

Still another very important point to consider, as to the superiority of the suprapubic operation, is the question of

emasculation. Langenbeck, as a result of his vast experience, believes that often the seminal ducts are cut and sterility follows. Halberstadt reports eighteen lateral lithotomies in which the patients, after having grown up, married, and only one out of these eighteen cases had issue.

If reliable statistics could be obtained on this point, there is no doubt this one fact alone would weigh very strongly against the perineal operation. The successful run of a series of lateral operations is brilliant, and shows wonderful skill on the part of the operator. The history of a patient should be examined years afterward in order to estimate the value of the operation from other points than its mere mortality. Dr. Charles Leale, whose experience has been very great in collecting evidence upon this point, related to me several cases under his own observation in which emasculation has been the result of the lateral operation. These patients had little or no hair upon the face, their voices were shrill, their testicles were atrophied, and they were, in fact, eunuchs. I doubt not but many medical men can narrate similar cases. I do not wish to exaggerate the importance of this subject, but simply to call attention to the point as a subject for further examination in the way of collective investigation.

The most important proof of the value of the high operation lies in the fact that heretofore the suprapubic method has been reserved for the removal of calculi above the average size where all other operations were inadmissible. If now the suprapubic operation with its recent modification is resorted to in those cases where the perineal operation only is employed, the results will be more brilliant. These facts demonstrate that the suprapubic operation, as now performed, is a far more successful operation than has been supposed from a reference to its early statistics. It will not, however, supplant crushing in cases of small and soft calculi; but in large stones its results already are far more favorable than perineal lithotomy. The limitations of lateral lithotomy are narrowed by the introduction of the high operation. Future experience will limit, in many cases, the cutting operation for stone through the perineum to those

in which a tight stricture of the urethra exists, and in which the operation of external perineal urethrotomy is indicated for the purpose of relieving the urethral stricture.

In conclusion, it may be said that suprapubic cystotomy, in its present form, presents to the practical surgeon a safe, reliable, and radical operation. It should be remembered, however, that the newly modified suprapubic operation has not been sufficiently submitted to the crucial test of time and experience to enable surgeons to estimate accurately its value under all conditions. Hence the great danger of generalization at present. Enough has been done already to convince the most incredulous that in the removal of large stones, and in tumors of the bladder, there is no question as to the superiority of the suprapubic operation.

The revival of this high operation, and its application in cases of traumatism of the bladder, have shown that surgical intervention can save human life in cases which but a few years ago were considered fatal. No one can dispute that the two recent cases of Sir William MacCormac bear brilliant testimony to this statement.

Finally, the rate of mortality by the suprapubic operation of about nine per cent. is high for a surgical operation; but a low rate of mortality for an operation performed under the conditions in which this method has been employed. In considering this mortality two facts must be remembered:

First. The causes of death in the majority of the cases are due to septic infection, and not to the immediate effects of the operation itself. The employment of more rigid antisepsis for the bladder should improve this rate of mortality. At the present time there is no ideal antiseptic especially and peculiarly adapted to vesical surgery. The attention of the Association should be directed to this important point.

Second. The largest and hardest stones have been reserved for the high operation. The patients have been, as a rule, in poor physical condition. Improvements in the details of bladder antisepsis and extension of the limits of the high operation to

include stones of somewhat smaller size, but not to embrace those suitable for crushing, and an earlier period of operation before patients are exhausted from chronic vesical irritation, will reduce the rate of mortality so as to compare favorably with any cutting operation for stone.

SUPRAPUBIC CYSTOTOMY FOR PURPOSES OTHER THAN THE EXTRACTION OF CALCULUS.

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So far as appears from the records, Nicholas Franco, of Lausanne, was the first surgeon who obtained access to the urinary bladder by an incision made above the pubes. His operation was performed in 1560, for the removal of a calculus; and although it was successful, he is quoted as advising others not to follow his example. The history of the suprapubic section, for the three centuries and a quarter from that time to the present, is as curious as it is interesting.

Soon after Franco's publication (in 1580), Rousset claimed to have discovered this method, in ignorance that any one had preceded him. Again, in 1719, it was rediscovered by Douglas, who, in turn, said he had known nothing of Rousset's invention. Douglas, somewhat extravagantly, says he "found innumerable instances, in authentic authors and army surgeons, of accidental wounds of the bladder being perfectly cured."[1] Yet it does not seem to have occurred to him that access to the bladder by this route might be made available for any other purpose than the removal of stone.

Proby, in 1700, had given an account of a case met with by him in 1694, in which he had extracted a bodkin from the bladder of a young woman by incision above the pubes; but this was very analogous to a case of stone.

[1] Lithotomia Douglassiana, 1720.

For whatever purpose intended, however, the suprapubic section of the bladder has been, until very recent times, regarded by most surgeons with a species of superstition, and my impression is that in schools and by private instructors it has either been wholly passed over, or mentioned only with disfavor. During my own pupilage at the University of Pennsylvania, from 1850 to 1853, I do not think I ever heard any reference made to it; nor was my attention ever called to it as a thing to be done, until its performance in a case of stone by the late Dr. H. Lenox Hodge, extraction by the perineal wound having been found impossible. This was in 1874; the affair was much discussed by other surgeons of Philadelphia, and the procedure was generally condemned as a desperate and even foolhardy venture. My opinion now is that it was eminently proper, and that the only mistake made was in not adopting it in the first instance.

In November, 1883, I was called in consultation with Dr. Donnèl Hughes in the case of a man who had a large piece (five inches long) of a shawl-pin in his bladder. I advised its removal through an opening above the pubes; and the ease of this operation, as well as of the after-treatment, and the prompt recovery of the patient, impressed me greatly. Since that time I have had occasion to reach the bladder by this route in a number of cases, some of which will be presently detailed. This experience has led me to inquire into that of others, and my conviction now is that there is a weight of evidence in favor of such procedures, which must make it a matter of surprise that they are still looked upon so much askance by the great body of surgeons, and, indeed, are unknown to so many. That it is so, let me adduce two proofs:

A writer in the *British Medical Journal* of January 2, 1886, asks for

"The best way to use cocaine in a case of enlarged prostate, necessitating the use of the catheter nearly every hour. There are also great bearing-down pain and prolapse of the rectum. The patient is seventy-six years old. As he lives in the country, he will have to apply it himself. I would be thankful for any suggestion that would benefit

the patient, as he has had all the ordinary remedies, and nothing seems to have benefited him except morphine suppositories."

Some very similar cases, wholly relieved by suprapubic section, will be presently given.

Again, a deservedly prominent surgeon and teacher has lately expressed the opinion, after speaking of the perineal and suprapubic sections into the bladder, that "extended experience alone will suffice to indicate clearly which should be regarded as preferable in the ordinary run of cases." He states further that the suprapubic operation has "disadvantages," but does not specify them.

I do not wish to appear as an advocate of the suprapubic section as against all other methods of access to the bladder; but simply to discuss the question whether or not the objections which have prevailed to place it in the background, are shown by reason or by experience to be well founded. In so doing, it will be my endeavor to avoid bringing in the matter of hypogastric lithotomy, which has been so ably and so thoroughly handled by Dulles, of Philadelphia, and by others; but it will not be easy to leave it wholly aside.

With regard to any proposed surgical procedure, the questions which must arise are:

How far is it free from risk in itself?

How fully does it effect the object in view?

What are the difficulties attending its performance?

And in comparing any procedure with others having the same end, the same questions must arise, but in the comparative form:

Is it more, or less safe?

Is it better calculated, or not so well, to effect the desired object?

Is it easier of performance, or more difficult?

In the present paper, as before said, my purpose is rather to inquire into the correctness of the prejudice, or neglect, under which the suprapubic section has been allowed to lie. I shall not undertake a comparison of this procedure with the other

methods of entering the bladder, unless incidentally and in reference to certain points; the questions above stated will therefore be considered only in their first form.

Now there are certain severe tests to which operative procedures may sometimes be subjected.

One is, the resort to them under very unfavorable circumstances: as by the patient himself; by ignorant persons; by surgeons, with rude or inadequate appliances; or when accident does roughly what the surgeon would do with care. If the results of such cases are found to be good, the fact constitutes a strong argument in favor of the value of any such procedure as a surgical resource.

Another is, the resort to them in especially severe or difficult cases. A method or an operation, which in a great emergency is more available than those in common use, must have something to recommend it when the stress is less urgent.

The penetration of the bladder by the suprapubic route has been thus tested, according to the records.

Carpue quotes from Rousset the history of a citizen of Orleans who, in 1560, was stabbed in the belly with a broad dagger; his urine for nineteen days and nights flowed through the wound, which healed easily after a catheter was passed through the urethra.

Also the case of a man named Conrad, who, in 1558, had a ball shot into his body. It was extracted, with a quantity of calcareous matter; urine passed by the wound for twelve weeks.

Also a wound of the bladder by a bull's horn, and another by a broad-sword; both of which did well.

Gross mentions the classical case of Jean de Dot, who, in the seventeenth century, cut himself in the linea alba, and extracted a stone the size of a hen's egg from his bladder. He also quotes from Fodéré a case in which a man "plunged a knife above the pubes into the viscus [bladder] to relieve a painful retention of urine. The peritoneum was not injured, and recovery ensued." (I did not succeed in finding this account in the only edition of Fodéré to which I have had access.)

Treves and Sexton have each reported a case similar to the preceding; both occurred in sailors at sea, and no ill consequence ensued in either.

As to the resort to suprapubic section in urgent cases, I need only mention here the many instances on record of the extraction, by this method, of calculi too large for removal through the perineum; but shall have occasion later to cite other evidence of the kind, some of it from my own individual experience.

Permit me now to cite the opinions of authors as to the hypogastric operation in general, exclusive of its use as a method of lithotomy; then to see what the anatomists have to say about the region concerned; and next to test these views by the records of cases. I will then venture to state my own experience; and, finally, will offer some remarks upon the methods of procedure.

To begin, then, with the opinions of surgical writers in regard to the suprapubic section, from the time when the first formal statement was made as to its employment in cases of retention of urine. Here, as well as in the subsequent citation of recorded cases, it has seemed to me best to follow a chronological order, and not to group the opinions or the experience as for or against the operation. Nor have I separated the different procedures—aspiration, puncture, or section. My object is to consider rather the route than the special method; to see whether peculiar dangers or difficulties attend the entrance into the bladder through the portion of its anterior wall uncovered by peritoneum.

Dionis, speaking of the high operation for stone, says:

"I do not consider this operation so dangerous as one might imagine; on the contrary, I think it involves less risk than either the greater or the lesser apparatus; the duplicature of the peritoneum, in which the ancients placed the bladder, does not exist, as I have shown in my published *Anatomy;* the bladder is situated outside of the peritoneum, so that it can be opened without touching the membrane, or encroaching upon the cavity of the lower belly."

Sharp, in 1761, was, as before mentioned, the first author of note, so far as I know, to speak of the suprapubic puncture for drawing off the urine. He says:

"This method has been occasionally followed by some eminent surgeons for many years, and is still approved of, but it is not recommended as having those superior advantages which, in my opinion, belong to it. It is an operation of no difficulty to the surgeon, and of little pain to the patient, the violence done to the bladder being at a distance from the parts affected; it is equally applicable whether the disorder be in the urethra or the prostate gland."

He then goes on to discuss the proper length of the canula to be left in the bladder, which he thinks should be two or two and a half inches; and the proper point for the puncture one and a half inches above the pubes.

Lawrence Heister says:

"Lastly, there is still another and most ready method of performing the operation according to the high operation, in which the trocar is passed into the anterior part of the bladder immediately above the juncture of the ossa pubis, where the incision is made for the stone in the high operation. Here the bodkin being extracted, and the urine discharged by the canula, the latter is to be secured in the wound by a bandage fastened round the body, that the urine may be retained or discharged at pleasure, until the cause of the suppression be removed; after which the wound may be healed by the bals. capiv. covered with lint and a plaster. Though this operation is but seldom performed by surgeons in a suppression of urine, I must needs declare it, in my opinion, to be very necessary and convenient, where nothing extraordinary forbids, since it is also recommended by Rossetus, Riolan, and Tolet; and since it appears from anatomical experiments that the bladder may be thus safely perforated, when distended with wind or water, without incurring any dangerous symptoms. And accordingly we find it has been put in practice to a good purpose by Turbier, Mery, Douglas, and Middleton; which two last recommend this method of perforating the bladder to be more safe and easy than that in the perineum. We have an instance of the success of this operation given us by Werlhoff; but here the surgeon did not use the triangular bodkin or trocar. He first divided the integuments with a scalpel, and then

perforated the bladder near its neck with a large-sized lancet; after discharging the urine, he introduced a tube, and secured it in the wound for nine days. And thus the patient was happily cured.

"When the cause of the disorder cannot be removed, in a person advanced in years, and when it proceeds from a callus formed from some fistula in the urethra, a scirrhus of the prostate, a large stone, a palsy of the bladder, or some other obstinate malady; in such cases the patient should constantly keep a silver pipe in his bladder as long as he lives, made with a valve and screw to open and shut, that his urine may not come away incessantly, but when the patient desires it."

Frére Côme, after discussing hypogastric lithotomy, speaks of puncture of the bladder for the evacuation of urine; he mentions the danger of wounding the opposite wall of the viscus, and recommends a curved canula described in 1751, by the use of which, he states, several lives had been saved. It seems to have been a segment of an exact circle.

A case in point is then given, which occurred in 1776.

John Hunter, who died in 1793, spoke very favorably of the suprapubic puncture of the bladder, except where the patient is very fat, or the bladder greatly contracted. He does not refer to any dangers, but only to difficulty in the performance of the operation.

Weldon, in 1793, speaking of the different methods of puncturing the bladder, thinks that each one has its advantages. In the suprapubic, he regards the peritoneum as the only important structure endangered. He thinks that in corpulent subjects the bladder may not always be easily felt; and would prefer the anal operation if the natural passage is not likely to be easily restored.

Dorsey, in 1813, speaks very highly of tapping the bladder above the pubes for retention, and quotes John Bell as saying that, as in strangulated hernia, *delay is the greatest danger.*

Howship, in 1816, merely mentions the suprapubic procedure, and says the rectal is "infinitely superior to either of the other methods."

Abernethy, in 1822, says:

"All the experience I have had has tended to convince me that the puncture above the os pubis is an innoxious and ready mode of discharging the urine when it cannot be discharged by the natural passages."

Sir Charles Bell, also in 1822, seems to think all the operations equally good.

Sir A. Cooper, in 1823, in a lecture, said that he had seen quite enough of the suprapubic operation, but gives no reason except that a Frenchman once exposed the intestine in performing it.

In 1827, Ducamp describes this procedure as easily performed, attended with little pain, and preferable to either of the other methods of section.

Ségalas, in 1828, says that he had himself never yet found it "needful to adopt the extreme means, puncture of the bladder." But he gives the preference to the hypogastric method if any is demanded.

In 1832, Phillips says that the peritoneum is much more apt to be wounded in the recto-vesical operation, where we must trust to the finger as a guide, than in the suprapubic, where we have ocular demonstration. He says that in the latter method there is less irritation, and that the canula causes less inconvenience; and pronounces it "more certain, more easy, more convenient, and less dangerous."

Amussat, in the same year, speaks very favorably of the method.

Brodie agrees with the opinion of Weldon, before quoted.

Guthrie, in 1834, positively objects to all forms of puncture; he says:

"The operation above the pubes is dangerous, inasmuch as an extravasation of urine may readily take place after it, and lead to the formation of matter and other evils of serious magnitude; it should never, therefore, be had recourse to in cases of retention from stricture."

Parrish, in 1836, speaks very decidedly in favor of the tapping of the bladder above the pubes, from his own experience as well as from that of his preceptor, the eminent Dr. Caspar Wistar. Cases in their practice are elsewhere quoted.

Malgaigne, in 1854, is said to have used these words: "puncture of the bladder is an operation as simple and as innocent as puncture of the peritoneum in ascites." The reporter, M. Vangaver, quotes Malgaigne as especially in favor of puncture (suprapubic) in cases where the urethra is closed after instrumentation.

Dr. F. H. Hamilton, in 1872, after describing the suprapubic operation, says:

"The operation through the rectum is more easily performed and is comparatively safe, and ought always to be preferred unless some condition of the rectum or of the prostate should seem to render it unsuitable."

Gouley, in 1873, speaking of the suprapubic puncture, says:

"This mode of relieving retention of urine has proved very efficient, by giving time for the subsidence of congestive swelling in the prostate and in the vicinity of strictures of the urethra, so that in a few days the canal has become pervious to instruments. The punctures have healed readily in all the reported cases, and perforation of the peritoneum, and even of a loop of intestine, has not been followed by any untoward result."

Gross, in 1876, says:

"Puncture of the bladder above the pubes has generally been regarded as even more objectionable than by any other route, not because of any particular difficulty in the operation, but because of its greater liability, as has been conjectured, to be followed by an escape of urine into the peritoneal cavity and the surrounding connective tissue. Both events are to be dreaded, especially the former, which is almost certainly fatal in from thirty-six to forty-eight hours from its occurrence."

He goes on to say that it is indicated "in cases in which an artificial outlet for the urine is desirable for a long period."

"When the obstruction to micturition is complete, and the capacity of the bladder is greatly diminished, so that a resort to the catheter becomes necessary nearly every hour, rendering the condition of the patient one of extreme misery, with rapid failure of the strength, the permanent retention of a tube in the bladder above the pubes may be advisable to avert impending death. An opportunity is thus afforded to the water to drain off almost as fast as it is secreted, and the bladder, placed in an easy, quiet state, is prevented from constantly contracting on its contents."

Bryant, in 1879, expresses the opinion that in safety and efficiency the suprapubic puncture is not to be compared with that by the rectum. In his last edition (1885), however, he says that in cases of tumor the section above the pubes may be preferable in some cases, as "when the growth is at the fundus, or very large."

Teevan, in 1880, says that the special risk of the hypogastric puncture is urinary infiltration, causing peritonitis.

Mr. T. Smith, in 1881, speaks very favorably of the operation, from a large experience with it. His cases I have quoted elsewhere in this paper.

Spence, in 1882, says: "The operation is not a satisfactory one; it is attended with some danger, and there are few who would consider it comfortable to be compelled to micturate through the front of the abdomen." He thinks a catheter can always be passed, by care and perseverance.

Sir H. Thompson, in 1883, after describing several modes of opening the bladder by the suprapubic route, expressed the opinion that the perineal opening "bids fair to be on the whole more useful, and more generally available in most of the instances in which efficient surgical relief is demanded."

Mr. Edmund Owen, in 1885, says with reference to the operations for stone in children:

"If a young surgeon did not consider himself competent to undertake the ordinary English operation (lateral lithotomy), he could hardly be trusted to resort to the high operation, even with protection of spray and gauze."

This expression would seem to indicate that the writer looked upon the suprapubic section as the more difficult procedure of the two; an opinion which can scarcely have been based upon practical experience in this matter.

M. Drouineau, at the French Surgical Congress in the same year, is reported to have said:

"In cases of retention of urine complicated by false passage, hypogastric puncture of the bladder should be done immediately, in preference to recto-vesical puncture. In two cases I have subsequently had no difficulty in catheterism. In certain troublesome cases, one might then practise hypogastric puncture first, and afterward catheterism, rendered thereby easier."

Erichsen, in 1885, says that the suprapubic operation can very seldom be required in enlarged prostate; but in speaking of stricture he refers to it as "undoubtedly easy of performance, and sufficiently safe, though not free from the danger of infiltration of urine into the tissues around the puncture, and the inconvenience of a fistula being left."

Kapteijn, a Dutch surgeon, is quoted in the *Lancet*, in 1885, as advocating suprapubic aspiration in cases of retention.

In 1886, Professor Chiene says that in retention of urine from the superaddition of acute inflammation with spasm to an old organic stricture,

"If after a fair trial with instruments he [the surgeon] fails to relieve the retention, he should aspirate above the pubes, continue the use of fomentations and sedatives, and on the following day he will find either that the retention is relieved, or that he is now able to pass an instrument along the urethra into the bladder."

But he says further: "Repeated aspirations in bad cases of stricture with retention are not, however, to be recommended." In such cases he regards perineal section as preferable.

Professor J. Greig Smith, speaking of the exploration of the bladder, and the removal of tumors, etc., says that he is convinced by his experience

"that in the matters of affording greater facility in diagnosis, more freedom in operating, and fuller potentiality of extending the opera-

tion to removal of portions of the bladder, the suprapubic is by far the superior surgical method."

Professor Konig, at the Fifteenth Congress of the German Society of Surgery, in 1886, expressed an opinion, which I may be allowed to quote here, although he referred to cases of calculus only:

"With regard to the high and perineal operations for removal of stone, it is stated that, whilst the risks of bleeding in the two procedures are about equal, the latter is almost quite free from danger to life, whilst the former, both from its anatomical conditions and from the risk of septic phlegmon of the anterior abdominal wall, is by no means a safe operation."

Mr. G. Buckston Browne, in a recent communication, refers to his statement in Heath's *Dictionary of Surgery*, that "fatal extravasation and abscess have been known to follow a second aspiration," and mentions Treves's case, reported in 1880. He thinks repeated aspiration bad; but would substitute puncture with a trocar and canula, the latter to remain. He thinks aspiration would certainly be bad in the case of a "rotten" bladder.

I desire next to ask your attention to the expressed views of leading authorities as to the anatomy of the hypogastric region, as concerned in this operation. And I may remark that it is one of the evidences of the slight heed paid to everyday things, that, although these parts are continually exposed, and even examined in autopsies, there is little exact knowledge of them.

The essential point of this inquiry is, of course, the relation of the peritoneum to the bladder-wall and to the parietes of the abdomen. If the risk of wounding the peritoneum is real and constant, it is not, even in these days of abdominal surgery, to be lightly encountered.

By way of further proof that such an inquiry is not superfluous, let me state that in the fifth edition of the well-known and elaborate *System of Practical Surgery*, of the late Sir W. Fergusson, there are two cuts, made by one of the most accomplished of anatomical artists. In one (Fig. 425, p. 689) the

suprapubic portion of the bladder is represented as affording abundant room for puncture or incision between the symphysis and the reflection of the peritoneum. In the other (Fig. 459, p. 728), where the bladder is supposed to be equally distended, the reflection of peritoneum is represented as almost in contact with the symphysis.

French anatomists have paid more attention to this matter than have those of any other country; and their views will appear from the following extracts:

Malgaigne (*Anat. Chir.*, tome ii. p. 477) says that when the bladder is full,

"it rises up largely above the symphysis pubis, and applies itself against the anterior wall of the abdomen, pushing the peritoneum upward, an essential circumstance upon which are based hypogastric cystotomy and lithotomy. But, which it is not less essential to say, in proportion as the bladder rises, its fundus departs from the abdominal wall, and between the two there descends a fold of peritoneum which it is important to avoid wounding. Many surgeons, misled by the commonly received notion that the peritoneum never descends upon the anterior face of the bladder, imagine that it is sufficient to stretch this wall by means of the *sonde-à-dard*, or ordinary sound, to divide it safely. Nothing is more imprudent than such a course; and in a recent *concours*, in which hypogastric lithotomy had to be practised on the dead subject, most of the candidates, trusting to the sound, wounded the peritoneum. Frére Côme, and Souberbielle, great lovers of the sound, added, however, a precaution infinitely more valuable, which, for my part, I hold to insure safety; it consists in carrying the finger along the anterior face of the bladder, and curving it, to push upward the fold of peritoneum, which is only connected with the bladder by loose and easily torn cellular tissue."

Tillaux (*Traité d'Anatomie Topographique*, p. 841) discusses the whole question with his usual clearness and vigor. He dwells particularly on the importance of what he calls the "antevesical cavity," the mass of loose areolar tissue in front of the bladder, between it and the symphysis, and then goes on as follows:

"What is the relation of the peritoneum to the anterior face of the bladder?

"Let it be remembered that the urachus is fixed to the apex of the bladder, and that when the organ is empty, the peritoneum, reflected over this cord, passes directly over the posterior face of the bladder, in such a way that the anterior face is completely bare of it. It is generally taught that the bladder, in mounting up in the abdomen, pushes the peritoneum up above it, and comes to put itself *in its whole altitude* directly in contact by its anterior face with the abdominal wall, no serous membrane intervening between them.

"Several anatomists, Malgaigne in particular, have contested this view, but M. Sappey, above all, has shown the incorrectness of this description. He has demonstrated that a portion of the anterior face of the distended bladder is covered by peritoneum; he has also pointed out that the bladder becomes distended mainly at the expense of its posterior face, and that it there undergoes a tipping movement, by which its apex is inclined forward.

"These are the exact facts: As the bladder rises, it does form a cul-de-sac of peritoneum between its anterior face and the abdominal wall; but I [Tillaux] cannot admit the mechanism ascribed to it by Sappey, and still less the deductions he draws in regard to operative measures.

"M. Sappey says: 'The peritoneum descends on the anterior face of the viscus in pushing back (*rabattant*) the urachus against this, and it descends the more as the dilatation becomes more marked;' and further, 'such is the mechanism in virtue of which the peritoneum drops between the abdominal wall and the bladder.'

"No, the peritoneum does not descend; on the contrary, it rises. In swelling upward, the bladder carries with it the portion of peritoneum situated just above the pubes. In proportion as the bladder expands, its summit widens, so as to offer almost a superior face; and the part of the bladder situated in front of the urachus covers itself with this portion of the peritoneum detached from the abdominal wall; the more the bladder expands, the more peritoneum there is detached from the abdominal wall, and the more of the bladder covered with it. When M. Sappey says, 'the cul-de-sac descends lower in proportion as the dilatation becomes more considerable,' the fact is so, but it is equally true that the height to which the bladder is stripped of peritoneum depends on (*est en raison de*) the depth of the cul-de-sac, since the portion which forms the cul-de-sac is precisely that which has been detached from the abdominal wall. From reading M. Sappey it would seem that the more the bladder is distended the less room there is to

penetrate into its cavity, since the more the peritoneum comes down. Now this is not correct; I repeat, the portion of peritoneum which invests the anterior wall of the distended bladder is no other than that which lined the anterior wall of the abdomen before the distention, as may be thus proved: measure the distance between the pubes and the peritoneal cul-de-sac, and that between the cul-de-sac and the apex of the bladder—that is to say, the insertion of the urachus—the distance is the same, and cannot be otherwise. Then the space uncovered by peritoneum is so much the larger as the cul-de-sac is deeper—that is, as the bladder is more distended. The peritoneum plays no active part in the distention of the bladder—does not descend—its *rôle* is purely passive; the bladder crowds upward, and is but partly covered."

Cruveilhier and Richet only briefly refer to the fact of the accessibility of the bladder above the pubes.

Bourgery and Jacob, in their splendid work, *Traité Complet de l'Anatomie de l'Homme*, tome v., Pl. 55, Figs. 10 and 12, represent the peritoneum as covering all except a very small portion of the anterior surface of the bladder.

The subject is entered upon more at length by Jarjavay, who (*Traité d'Anat. Chir.*, tome ii. p. 588) speaks of the loose cellular tissue which permits of distention as the bladder is full; but says that when from chronic inflammation lymph has been effused in its meshes, it is no longer distensible.

"M. Petrequin, who has established this point by clinical as well as post-mortem observations, advises for this reason that the hypogastric puncture should be made immediately above the pubes. This practice differs from that prescribed by most authors, according to whom the place of election is at a distance of four centimetres (Malgaigne), of twenty-seven millimetres (Velpeau and Coster) above this bone. The danger of wounding the peritoneum justifies the counsel of the Lyons surgeon, in cases in which adhesions have engaged the bladder and prevented its upward development; but when the viscus is free, there exists between it and the symphysis a cellular interval where the trocar might go astray and pass into the pelvis without encountering the vesical wall. Thus, in the majority of cases, puncture at twenty-seven millimetres above the pelvic brim is preferable.

"We have several times had occasion to remark that the anterior

face of the bladder is without peritoneal covering; and on this anatomical arrangement are based hypogastric puncture and lithotomy. Yet it has happened that the serous membrane has been wounded as the bistoury was carried upward toward the upper part of the bladder.

"The gravity of this accident has certainly been overestimated. What renders it formidable is much more the effusion of urine into the serous cavity than the entrance of air. Now, upon contraction of the bladder, the two wounds—that in the anterior wall of the bladder and that in the peritoneum—no longer correspond, and, hence, effusion of urine into the serous cavity is less easily produced. According to Velpeau, Douglas, Thornhill, Frére Côme, Souberbielle, Crozat, and Leonardon, each had the misfortune to wound the peritoneum, yet their patients made perfect recoveries. The employment of the sonde à dard, and the making the incision from above downward, may, to a certain extent, guard against this accident."

This author in another work (*Récherches Anat. sur l'urètre de l'Homme*) gives three plates of sections of frozen bodies, and in them the peritoneum is represented as actually in contact with the symphysis pubis. The bladder is in each case contracted; in plates vi. and vii. very much so, and its walls very thick.

In the *Philadelphia Medical Times* of May 31, 1884, a report is quoted from the *London Medical Record*, of a discussion on the anatomy of the hypogastric region, the subject having come up apropos of a suprapubic lithotomy performed by Després. This gentleman regarded the pyramidalis muscles as important landmarks, whereas MM. Sée and Bouley thought they varied in size and situation.

"As to the relations of the prevesical cul-de-sac of the peritoneum to the upper border of the symphysis pubis, a careful dissection of thirteen bodies had led M. Bouley to the following conclusions: When the apex of the bladder is situated nine to thirteen centimetres higher than the symphysis, the height of the peritoneal fold above the same point can be found by deducting four centimetres from those numbers. When the bladder reaches five to nine centimetres above the symphysis pubis, three centimetres must be deducted. It is, however, essential to remember that the peritoneal fold stands relatively

higher in fat than in thin people. M. Bouley has also repeated the experiments of Petersen, who had the idea of raising the peritoneal *cul-de-sac* above the symphysis by means of an India-rubber ball introduced into the rectum and distended by water; this process seems to answer well, especially in fat people. It is necessary to inject 400 to 600 grammes (about one pint) of water."

This estimate is for many cases too high.

Holden (*Landmarks, Medical and Surgical*, p. 31) says that

"With a bladder distended half way up to the umbilicus, there is a space of nearly two inches above the symphysis where the bladder may be tapped without risk of injury to the peritoneum."

So far, the evidence of anatomy has been favorable. But the conditions are not always the same. They are, of course, well known to vary with age. Thus in children the bladder rises above the pubis, and is an abdominal rather than a pelvic organ; while with later development the bony framework grows much more massive, and the bladder drops down behind it, so as to occupy the anterior part of the pelvis, and only to appear above the pubis when considerably distended.

In a leading article in the *Lancet* for January 30, 1886, it is stated that

"M. Polaillon recently showed at the Soc. de Chir. the urinary organs of a calculous patient, upon whom he had unsuccessfully attempted suprapubic lithotomy. The bladder was distended by an injection of 150 grammes of fluid, and the rectum was distended in the usual manner—yet the peritoneum was found to extend over the bladder quite down to the pubes. He verified this by making an incision into the serous sac, through which he introduced his finger and exactly traced the reflection of the peritoneum. The wound was sewed up. The wound healed, and several months later the patient died of pyelonephritis. At the necropsy the bladder was found to be hypertrophied and contracted, fitting closely around a stone measuring in circumference four centimetres by two. The peritoneum passed quite down to the pubes. Ureters dilated."

It would obviously be a very awkward thing to attempt the tapping of a bladder so covered. I cannot but think, however, that the condition of things here mentioned was the result of some pathological change. Certainly it was altogether exceptional; but the possibility of its occurrence should be borne in mind.

Let us now look at the records of experience in the performance of suprapubic operations. It is very possible, I must admit, that many cases of this kind may have occurred which have not been published; and if so, it is highly probable that among these unreported instances a large number were failures. For unfortunately, surgeons are too apt to let the world know of their triumphs, while they say nothing about their ill-successes. Yet it has seemed to me fair to present what records there are, and to draw from them such inferences as they seem to warrant. The length of time over which these experiences have extended was to me a matter of considerable surprise.

1725. Daniel Turner, in his chapter on "Wounds of the Bladder," speaks with high praise of the suprapubic section for stone, as performed by friends of his at St. Bartholomew's Hospital. He says:

"I have been witness of the large solutions of continuity this part of the bladder undergoes; yet, by help of a medium furnished by its sides, after digestion, together with that from the superincumbent parts, the same in little time consolidates, and is perfectly agglutinated."

He then cites three cases of accidental wounds of the bladder, successfully treated; and quotes in full the well-known and curious account of the operation done by Probyn, in 1694, for the removal of an ivory bodkin from the bladder of a girl. In this case the incision is stated to have been made at the outer side of the rectus muscle.

Dionis, who was certainly one of the best informed and most intelligent writers of the last century, goes very fully into the subject of the treatment of retention of urine, and describes the

perineal operation; but does not even hint at the possibility of affording relief by puncture or section above the pubis. Yet he gives a most excellent account of the high operation for stone.

1761. Sharp had evidently been practically familiar with the suprapubic operation for the relief of retention of urine, which he says had "been occasionally followed by some eminent surgeons for many years, and was still approved of;" but the only instance he mentions is one in which a trocar of too great length had wounded the rectum.

1768. Heister cites the experience of Turbier, Mery, Douglas, Middleton, and Werlhoff, but gives special mention to only one case, a successful one, in the practice of the last-named surgeon. He distinctly asserts that they had all obtained favorable results from the procedure.

1775. James Lucas made a suprapubic puncture in the case of a man aged thirty, who seventeen days previously had received an injury to the perineum, followed by abscess. Recovery took place, but a year later the man had still a perineal fistula.

1776. Frére Côme operated with great success upon a gentleman who had, for twelve years, suffered severely from the effects of traumatic stricture; the patient himself wrote the account of his case fourteen months after the cure was accomplished.

1788. Sir E. Home gives details of a case in which he assisted John Hunter in performing suprapubic puncture in a man aged thirty, strictured for nine years. Cellulitis ensued, and there was a suspicion of peritonitis. On the removal of the tube from the bladder, at the end of forty days, it brought with it a slough, which was followed by nearly a pint of pus. Several abscesses formed, and sloughs came away, but in thirteen weeks the man was well, and continued so fifteen years afterward.

1789. Francis Turner treated a boy aged three, for retention of urine from obscure cause. Puncture above the pubes was resorted to on the third day, and again on the fifth, when the canula was left in place. On the eleventh day urine passed by the urethra, and on the thirteenth the canula was withdrawn. An abscess afterward formed in the scrotum. Two and a half

months later, the general health began to fail, and death ensued in about four weeks. An obscure account is given of a tumor found at the autopsy.

1790. Cheston recorded a case of retroversion of the pregnant uterus obstructing urination, in which relief was obtained by a suprapubic opening. He refers, in a note, to another case in which the uterus was punctured by too long a trocar, with fatal result.

1793. Noël reports three cases, of men aged sixty, sixty-six, and sixty-seven, respectively; in the first there was on the eighth day "suppurative gangrene" of the perineum and scrotum. On the removal of the canula the wound healed.

The third case is remarkable, in that the surgeon states that the canula was changed every tenth or twelfth day. He had in other cases feared to do this, because he believed

"That the bladder, in emptying itself, would leave the inner wall of the hypogastric region to go down again into the pelvis, and that in consequence of this displacement the opening made in the bladder would no longer correspond with the outer wound, which would not only render the reintroduction of the catheter almost impossible, but would moreover subject the patient to the danger of infiltration of urine."

1804. Pascal Baseilhac (nephew of Frére Côme), in a work published in defence of his uncle's views, asserts that suprapubic puncture of the bladder had been very frequently resorted to, not only by Frére Côme, but by himself, by Souberbielle, and by their pupil, M. Pot; and gives several cases, in one of which the patient was eighty-two years of age.

1813. Dorsey records a very favorable case.

1814. Vise, another very favorable case.

1819. Carpue, after a very brief description of the suprapubic puncture, says:

"My first objection to this operation is, that the urine is not evacuated from the bottom of the bladder. I remember, in a case where a common trocar was used, I dissected the parts; the bladder fell on the sharp edge of the trocar; this produced inflammation of the bladder

and peritoneum, which occasioned the death of the patient. In another case, a gentleman plunged a trocar through the linea alba; not any water followed. He passed a probe through the canula; he declared there was no urine in the bladder. The symptoms continued. The attendant surgeon was of the opinion that there was water. The patient died. The gentlemen examined the body; the bladder had burst. In truth, the trocar had pushed the bladder from its connection with the posterior part of the pubes, where it is slightly attached."

It seems to me that the unfairness of thus condemning an operation because of gross blunders in its performance, needs scarcely to be insisted upon; it is strikingly incongruous with the excellence of Mr. Carpue's book as a whole, and the more remarkable since he was a strong advocate of the high operation for stone.

1824. Gibson performed the high operation for stone, he thought, for the first time in this country. The patient lost his life, it would seem, through his own imprudence, a few days later.

1827. Lawrence is reported by Fereday to have twice tapped the bladder in the same man, for retention. The account given is not full or satisfactory.

1828. Parrish opened the bladder above the pubes after the failure of two attempts at rectal puncture, in the case of a man aged thirty-five, with injury of the perineum and scrotum. The relief given was immediate and complete; but a few days later the scrotum sloughed, bedsores formed, and death finally took place from hectic.

He relates also the case of an old gentleman, treated by his preceptor Dr. Wistar, for enlarged prostate, in whom a gold tube was introduced through a suprapubic opening, and worn for two years. The patient was completely relieved, so as even to ride on horseback. Thinking himself cured, he removed the tube; the symptoms recurred and he died.

1837. S. Oliver operated with success on a woman aged thirty-five. The account given is obscure.

Betton reported a case of rupture of the urethra by traumatism, in which suprapubic tapping of the bladder gave great

relief, but on the seventh day the patient died, it is stated, "from mere exhaustion and debility." At the autopsy "the membranous portion of the urethra was found lacerated for about the space of two and a half inches; a great deal of blood effused in the cellular tissue of the perineum." Free incisions in the latter region would probably have saved the man's life.

1839. Velpeau mentions a case in which he practised suprapubic puncture twice in three days. The patient died of peritonitis on the sixth day, and a small blackish spot was found in the hypogastrium in front of the bladder.

Yet he quotes a case in which the operation was twice done in the same patient; in 1828 by M. Vaust, and in 1834 by M. Voltem. The man wore a rubber tube, and had no trouble.

He quotes also from M. Nick the case of a man aged seventy-two, on whom hypogastric puncture was performed for an ischuria. The patient wore a canula until he died, a period of twelve years.

1841. Toogood published an account of a case of enlarged prostate, with retention of urine for four days; suprapubic puncture gave relief; the wound was carefully closed at once, and healed. About a year later, the irritation of a calculus in the bladder gave rise to fatal peritonitis.

1842. Macilwain operated on a man aged sixty-seven, for retention due to enlarged prostate. The patient was the subject of double inguinal hernia. There was no difficulty in the operation, which gave relief; but the patient died of exhaustion in forty-eight hours.

1844. Heylaerts reported a favorable case.

Chassaignac performed suprapubic section in a man aged sixty-four, who had had several previous attacks of retention from stricture. Urination was thereafter performed by the hypogastric opening.

In connection with this case Chassaignac proposed extraduction of a catheter, or as he calls it *retro-urethral catheterization.* The idea was strongly advocated, he says, by Rognetta, in the *Annales de Thérapeutique et de Toxicologie* for October, 1844. It has been promulgated by Brainard and others, but has never, I

think, been fully appreciated by surgeons, or duly noticed by authors.

1848. Syme reported a very favorable case in which this procedure was resorted to, on the fourth day, after rupture of the urethra, in a youth.

Brown recorded a case operated on by Mr. Luke; a man, aged fifty-four, strictured thirty-four years. A canula was inserted, and retained for one hundred and sixty-two days, when a cure had been effected by catheterization.

1849. Brainard published a case which deserves special mention. The man had suffered from gonorrhœa and gleet for eleven years. On the 8th of December, 1848, he was tapped, and a long canula left in. On the 9th of February following, a bougie was passed through the bladder forward into the urethra, and the stricture thus dilated. The canula was withdrawn March 4th.

I believe this was the first recorded instance in this country, of this excellent mode of practice. Chassaignac's case has been already noted.[1]

1850. Gisborne gives a case of distention and partial paralysis of the bladder from enlarged prostate, in a man aged sixty. Suprapubic puncture was resorted to with success.

Wakley operated in a case of retention from injury in a child aged twenty months. The canula was kept in for three days, when catheterization was found to be easy, and in eight days the child was discharged cured.

1851. Manson operated on a mulatto man aged thirty, crushed under timber. The bladder was paralyzed; for some unexplained

[1] In a leading article in the *Med. Times and Gazette* of July 15, 1876, mention is made of the fact that Volkmann had performed "posterior catheterization" in a boy aged six and three-quarters years, for the relief of rupture of the urethra; and it is claimed that the procedure had been adopted by Hunter, and by Verguin in another case of rupture of the urethra. In a later number, September 30th, Ranke claims to be "the experimenter in regard to this operation;" but he also says that Verguin's case was reported thirty years before the publication of Hunter's work on Syphilis. Neither Chassaignac's nor Brainard's case seems to have been known to the writer of the article, or to Volkmann and Ranke.

reason a catheter could not be passed. A tube was kept in about one month.

Monod reported a case in which, suprapubic puncture for retention being performed, the middle lobe of the prostate was wounded by the trocar.

1852. Maund employed this procedure in a case which proved fatal from rupture of the kidney.

1854. Waddell reported the case of a man aged seventy, with old stricture. Rectal puncture was tried unsuccessfully, and then a suprapubic opening was made, and a silver tube inserted *en permanence*.

Williams, in the case of a man aged thirty-two, with stricture and a ruptured urethra, made a suprapubic section with a view to the extraduction of a catheter. Failing in this attempt, forced catheterization was resorted to. A slough came away, and the suprapubic wound closed by the twenty-seventh day.

1856. Cazenave reported a similar case.

Van Buren was called upon to treat a man aged thirty-five, of very bad habits. He had been strictured for six or eight years, and had been twice subjected to perineal section, and twice to suprapubic puncture; he had also a large hernia. The opening above the pubes was renewed with a trocar. Death ensued from peritonitis, ascribed partly to extravasation of urine.

Lacroix gives the history of two successful cases in his practice in 1853, and refers to others.

Fox reported the case of a boy aged thirteen, with injury to the perineum. Suprapubic puncture (section ?) was done on the fifth day, and seven days later, the extraduction of a bougie. Nine days after this, an abscess burst between the bladder and the rectum; a perineal opening ensued from sloughing, but the boy recovered with only a large cicatrix.

1858. Nélaton spoke of suprapubic puncture as the method most frequently adopted in retention of urine; recommending a trocar and canula, the latter to be retained in place by tapes.

1859. Norman reported the case of an elderly man with enlarged prostate, in whom, after suprapubic puncture, the wound cicatrized around the catheter, which was withdrawn. The man

used a bit of bougie as a plug, and occasionally drew off his water with a female catheter. He lived several years.

Mr. Thomas Paget, after mentioning four cases, says of suprapubic section for retention: "This operation I have seen and practised for fully forty-five years."

1859–60. Mr. Sloan reports a case of fracture of the pelvis and rupture of the urethra, in which suprapubic tapping was done, but death from peritonitis occurred on the fourth day.

1861. Norton records a successful case in a child.

1862. Chassaniol reports a case in which he resorted to suprapubic tapping twice, at an interval of seven years. Two months after the second operation the man died, "of gradual absorption of urine." Is it not likely that there was disease of the kidneys, and failure of their function?

1863. Gason published an account of a man aged sixty-eight, who had for twelve hours been subjected to attempts at catheterization; false passages had been made, and much damage done. He died about thirty-six hours after suprapubic tapping, probably of secondary shock. There was sloughing, and perhaps pyæmic peritonitis.

1866. Callender gave the history of a man aged twenty-six, with retention from stricture. He had had gonorrhœa for over seven years. Suprapubic puncture was performed March 18th, and an elastic catheter kept in the wound. All went well until April 20th, when diffuse suppurative inflammation of the scrotum began, and was treated by free incisions. A silver canula was now substituted for the elastic one, and was left in for three weeks. It became encrusted, and the opening had to be enlarged. Sinuses had formed. October 27th, extraduction of a catheter was practised, a straight instrument was passed by the meatus, and the two were joined by dissection. After this the case was treated like an ordinary perineal section. Some calculi were extracted through the suprapubic opening, which soon closed afterward.

According to Keyes, "Maisonneuve was in the habit of puncturing bladders in this manner, with an ordinary fine trocar, at the Hôtel Dieu, Paris."

1867. Mackie operated on a man aged forty, who had had for thirty hours retention from stricture. A gum catheter was left in the bladder for forty-eight hours. On the second day urine passed by the natural route.

1870. Hulke, in the case of a man aged forty-two, found the suprapubic puncture very difficult on account of the patient's obesity, which was thought to preclude perineal access to the bladder. The trocar and canula penetrated two and one-half inches of fat. The canula was removed on the ninth day.

Draper reported the case of a man aged sixty-five, with enlarged prostate, in whom puncture, with the retention of an elastic tube, gave entire relief: death, however, occurred from exhaustion a week later.

1871. Sexton reports the remarkable case of a sailor who, while at sea, and suffering from retention, relieved himself by puncturing his own bladder above the pubes with a knife.

Calhoun saw at Langenbeck's clinic at Berlin a case of retention from enlarged prostate, in a man aged sixty-eight, in which suprapubic puncture was resorted to with perfect success.

1872. Stevens performed suprapubic aspiration upon a young Bengalee, for retention; next day the catheter was used, and later the stricture was cured by Holt's method.

A notable case was recorded by Sewall in the same year. A man aged seventy-two had retention for thirty-six hours, from stricture. Suprapubic section was performed, and a gum-catheter inserted; at the end of four days this was replaced by a silver tube, which was worn for ten weeks. The wound healed in three days after this tube was removed. Eight months later the patient caught cold, and suffered from retention again; another puncture was made, and the tube worn three or four weeks, when the cure was complete.

1873. Whittaker reported the case of a lad of eighteen, with rupture of the urethra; suprapubic aspiration was done, and recovery ensued.

Loomis reported the case of a man aged seventy-one, with retention from enlarged prostate, for which suprapubic aspiration was done five times; death taking place from pneumonia,

the parts were examined, and it was found that some of the punctures had wounded the peritoneum, but there had been no peritonitis.

Mr. Joseph Bell reported a case which had occurred under his care, in which a man of sixty-five, who had been cut for stricture in 1860, suffered from retention, and was relieved by aspiration above the pubes. This was thought to be the first operation of the kind in Scotland.

1874. Taylor reported a case of retention from enlarged prostate in a man aged seventy-four. Suprapubic aspiration was done seven times. After death, fifteen days later, no trace of the punctures could be perceived.

Rose reports the case of a man, aged sixty, with retention from enlarged prostate; a canula was inserted above the pubes, and remained ten days; the wound healed in two weeks.

Whitehead gives an account of a man, aged fifty-eight, with enlarged prostate and subacute cystitis; retention coming on, was relieved by suprapubic cystotomy, the edges of the wound in the bladder being stitched to those of the wound in the skin Death ensued from diarrhœa on the fourteenth day. Septicæmia was suspected.

Angelot reported a case which had occurred in M. Demarquay's service; a man, aged sixty-five, after being punctured seven times above the pubes for retention, died on the eleventh day. No trace of the punctures was discernible after death.

Hall, in the case of a man aged seventy-eight, performed suprapubic aspiration nineteen times in seventeen days.

A case is reported by Speir, in which the operation was repeated fifteen times; one by Guthrie, in which it was done eighteen times; and one by Brown, in which it was done fifteen times.

1875. La Garde reported a successful case of aspiration done with a hypodermic needle, a rubber tube, and a bottle with a canula passed through the cork.

Mixon reported the case of a man, aged sixty-eight, with retention for twenty hours, in whom the bladder was opened above

the pubes with a bistoury, and a female catheter inserted. Recovery was rapid and complete.

Taylor treated a case of retention from enormous hypertrophy of the prostate, in a man, aged eighty, by suprapubic aspiration. It was thrice repeated, with relief, but the patient died.

1876. Dora recorded the case of a clergyman aged sixty-four, with prostatitis, greatly relieved by suprapubic puncture, although death ensued from exhaustion about ten days later.

Porcher reported a case in which the operation was done thirteen times for retention.

Mention is made in the same year of a case in which Dr. Malherbe, of Paris, had the misfortune to break the aspirator tube in the bladder; the fragment was unextracted, and caused death. (It certainly seems strange that in this case the idea of direct section did not suggest itself.)

Volkmann reported the case of a boy, aged six and three-quarters, with rupture of the urethra, in whom he performed suprapubic section, with posterior catheterization. He thought that a similar operation had been done by Hunter, as well as by Verguin. Ranke, however, states that Hunter only made the suggestion, and that Verguin had reported his case thirty years before Hunter's work (*On Syphilis*) was published.

1877. Peixoto reports a case of old stricture of the urethra, with false passages; complete retention of urine, relieved by suprapubic puncture; vesical hemorrhage from over-distention; urethrotomy; cure.

Shepherd reports the case of a man aged sixty-two, in whom retention (probably from enlarged prostate?) was relieved by suprapubic aspiration done at least once in twenty-four hours for thirteen days. He says he has repeatedly adopted this course with satisfaction.

J. W. Browne reported a case in which a man aged forty-three, affected with stricture, was subjected to suprapubic puncture; the canula was removed after two days, and later, a puncture by the rectum was performed.

1878. Gay published the case of a man aged twenty-eight, for thirteen years the subject of stricture, who had retention,

and on whom suprapubic aspiration was done nine times in four days.

Howse reported the case of a young man aged twenty-two, whose urethra had been ruptured, with fracture of the pelvis. Seventeen months after, perineal section was done, and seven months later, suprapubic section, with extraduction of an instrument, and division of the stricture. A good result was secured. In the discussion on this case, Mr. Teevan is reported to have said that "numerous deaths had been recorded after suprapubic sections."

Wick gives the history of a man aged fifty-eight, with retention from enlarged prostate; catheterization was found impossible; suprapubic puncture was performed six times, each time at a different point; recovery ensued.

Vanderveer recorded the case of a man aged sixty-two, with retention from enlarged prostate; suprapubic aspiration was resorted to twelve times, then a canula was inserted, and by means of it a rubber tube. The result was excellent.

1879. Styll gives an account of a case of stricture with retention, in a man aged thirty-seven; aspiration above the pubes was done every twelve hours for three days, with good result.

Mr. Hulke also records a case of old stricture in a man aged forty, in which, after aspiration, the bladder was tapped above the pubes, a canula fastened in and retained four weeks. An instrument was then passed from behind forward, another from before backward, and the intervening tissue divided.

1880. Treves published a case in which retention was relieved by suprapubic puncture. The patient went out on the third day, but returned within a week, very ill. About three weeks later he died, and at the autopsy no trace of the wound in the bladder was found; there was suppurative pelvic cellulitis.

Campbell reported a case in which, after suprapubic aspiration on two successive days, on the third internal urethrotomy was resorted to. In a day or two there was inflammation at one of the punctures, followed by abscess, peritonitis, and death.

1881. Mr. Thomas Smith gives nine cases of suprapubic puncture, and says that he has, on other occasions, employed

the same means of relief for prostatic retention. He speaks of three cases of children, in which retention caused by the pressure of tumors had been thus remedied. In one case of stricture, in a man aged fifty-seven, puncture was resorted to, and on the second day pneumonia set in, which proved fatal. Mr. Smith had no idea that there was any connection between the operation and the issue of the case.

Stein quotes a case of Liston's, in which a man had a cyst which caused dysuria by falling into the urethra. The cyst was removed through a suprapubic opening; the wound was closed, and the man recovered, living for some time.

Also from Billroth, the case of a boy aged twelve, in whom perineal cystotomy was done for a tumor. A suprapubic incision was then made, both recti muscles were cut across, and a transverse incision was made in the bladder wall. The tumor was removed; through drainage was kept up until the fifth day, and in thirty-four days the wound had closed.

Also from Volkmann, the case of a man aged fifty-four; the operation was the same as in Billroth's case, except that the upper wound was "made on the finger passed through the perineal wound." A tumor having been removed, the upper wound was closed by sutures, and a drainage tube was placed in the lower. Peritonitis ensued, and death on the third day.

Also from Marcacci, the case of a man, aged fifty-four. An incision thirteen centimetres in length was made, an enormous tumor removed, and the wound in the bladder closed with four catgut sutures, that in the abdominal wall with metallic sutures; antiseptic dressings were applied. On the tenth day the metallic sutures were removed, and a few drops of urine escaped from the openings where they had been. Urinary fistulæ remained, and the "patient died within two months after the operation, from extravasation of urine, pelvic abscess, and peritonitis."

Gross mentions the case of a farmer, in whom the wound made, through which a tube was worn for several months, reopened after fourteen years, the integuments having been the seat of erysipelatous inflammation. Urine flowed through

the opening for about four weeks, or until the patient died from constitutional exhaustion.

1883. Anger reported a case in which suprapubic section was performed for the relief of cystitis; on the third day an abscess of the kidney burst into the peritoneum, with fatal effect.

Hyatt recorded the case of a man, aged sixty, whose bladder he opened above the pubes for the extraction of a piece of metallic catheter. The peritoneum was opened, the orifice being three-quarters of an inch in extent; its edges were brought together and stitched to the abdominal wall. Recovery was complete in four weeks.

1886. Treves published the case of a man aged fifty-five, admitted to the London Hospital in August, 1885, with complete retention for thirty hours. He had had traumatic stricture for nineteen years, and for seven years his urine had dribbled away, the bladder having been during all that time so distended as to be visible above the pubes. Suprapubic puncture with a trocar was done, and a few days later a soft rubber tube was inserted in place of the canula. In May, 1886, he reported that he had worn the tube ever since, with a cork.

Southam gave an account of a case of papillomata of the bladder in a man, aged forty-one. Exploration was first made by means of a perineal opening; free access was then obtained by a suprapubic section, the tumors removed, and bleeding checked by means of hot water and tincture of iron. A good cure resulted.

Pitts reported to the Clinical Society of London a case of tumor, in a man, aged forty-five, removed by suprapubic section, with a good recovery. Sir Henry Thompson, on the same occasion, spoke of three similar cases.

Wile reports a case in which suprapubic aspiration was done twice a day for four days, with good result.

Harrison quotes a case from the practice of Mr. Mitchell Banks, in which suprapubic tapping was done at sea four days after a rupture of the urethra. Six days later, the man arriving at Liverpool, Mr. Banks made a perineal opening and through drainage. The patient made a good recovery.

Dr. W. H. Bennett recently reported to the Royal Medical and Chirurgical Society the case of a man aged thirty-eight, who had had retention of urine for three days. Aspiration was performed above the pubes, and extra-peritoneal rupture of the bladder immediately occurred. The abdomen was laid open, and the bladder thereafter drained by a perineal incision. For forty-eight days the patient did well; then an opening formed between the bowel and the prevesical cavity, and he sank.

In connection with the previous case, Mr. Bryant cited that of a man aged thirty, in whom suprapubic aspiration was done for retention, and later a perineal section. After death, suppurative peritonitis, with a sloughing abscess from extravasation of urine, was found.

He also mentioned the case of a man aged seventy-eight, with retention from enlarged prostate; suprapubic puncture was performed seven or eight times, and after death it was found that each of the six openings "would allow of the escape of urine into the peritoneum." (I must confess that this statement puzzles me, if the operations were properly performed).

Prof. Humphry referred to a case of enlarged prostate with retention, in which suprapubic puncture was followed by fatal extravasation of urine.

Mr. Baker has published an account of a man aged fifty-five, affected with sarcoma of the bladder, for which a perineal operation was done October 11, 1884, and part of the growth removed. It however grew rapidly, and on January 1, 1885, suprapubic puncture was made, and a red elastic catheter introduced, with a tube converting it into a siphon, so as continually to draw off the water. January 16th, this began to be painful (by increase of the tumor?) and it was removed, a pad of absorbent wool being substituted for it. Death took place January 19th.

Mr. W. Thomas reports a curious case of obstructed micturition in a boy aged four, from congenital malformation at the meatus urethræ. Suprapubic section was done, and on the introduction of the catheter a valve-like septum was discovered and divided, after which a cure was readily effected.

He gives also a case of ruptured urethra in a boy aged eleven,

treated by perineal incision and suprapubic aspiration, with success.

Sheild gives his experience as decidedly in favor of the suprapubic puncture in cases of retention, and quotes the expression of one patient, that it was the easiest way in which he had ever had his water drawn.

1885. Thistle gives six cases, five of retention from stricture, and one of retention from enlarged prostate, in which the bladder was entered above the pubes. Three were aspirated, and three tapped, one of the latter being the patient with enlarged prostate, who was seventy-three years old.

In all the procedure was successful.

1887. Fairbanks reports a case in which a man aged seventy-six, after slight trouble for some weeks, had retention, which was for three days relieved by the use of the catheter; then this became impossible, and suprapubic aspiration was relied upon for fifteen days, during which all the urine was drawn off in this way, except once, when the catheter was used. Aspiration was performed thirty-two times. After this the catheter could be again passed, and by degrees the bladder resumed its function.

I propose now to give the results of my own experience in this direction; some of the cases, as will be noted, were extremely unfavorable, and yet the patients did well. Several of them, it seems to me, could not have been successfully dealt with in any other way than by suprapubic section.

I have already referred to the case which I saw with Dr. Donnel Hughes, in November, 1883, in which we opened the bladder above the pubes for the purpose of removing a foreign body, the patient making an uninterrupted recovery.

For several years it has been my practice, in cases of retention from stricture such as we ordinarily meet with, after the failure of a fair attempt at relief by catheterization, to draw off the urine by aspiration. Very generally an instrument has passed readily within the twenty-four hours succeeding the operation. I do not now remember having had occasion to do

this more than once in any one case, but my records in this respect are unfortunately quite imperfect.

One patient, with greatly enlarged prostate, was much relieved by the aspiration, and next day I succeeded in passing a catheter. His family, however, called in another surgeon without notice to me, and in a day or two I heard of the patient's death—from what cause I do not know. This is the only instance within my personal knowledge in which there was any ill consequence following aspiration, and here I see no evidence connecting the operation with the fatal event.

On the 7th of July, 1885, I was called by Dr. R. B. Okie, of Berwyn, to see Mr. G., aged sixty five, at Howellville, Chester Co., on account of retention of urine from enlarged prostate.

Mr. G. was a man seemingly in good health, but much distressed by frequent ineffectual calls to urinate, and by distention of his bladder. With a very long catheter I drew off his urine, but he wanted more permanent relief, as there was no medical aid within several miles of his residence.

I therefore, with the aid of Drs. Okie, Rickabaugh, and Roberts, on the same day etherized Mr. G., and performed the suprapubic section, putting in a glass ovariotomy tube, curved for the occasion. Dr. Okie made an ingenious arrangement with a piece of the thin gum-cloth known to dentists as "rubber dam," by means of which the urine as it flowed from the tube was prevented from coming in contact with the skin.

Two or three nights afterward the patient had a curious attack of almost maniacal excitement, which however soon passed off, and he became quite himself again. He began to sit up, and to be about his room; and was beginning to learn to pass the catheter for himself, when, on July 19th, making some slight effort, he fell dead.

A post-mortem showed the heart to be fatty, with vegetations on the mitral valve. There was an immense lobulated prostate, but the wound in the bladder was quite healthy and free from irritation.

Jacob O. C., aged forty-three, was admitted into the Pennsylvania Hospital, January 21, 1885, on account of retention of urine. He had been a hard drinker; had gonorrhœa at seventeen, for the first and only time; became strictured at twenty-two, and in 1873 was "cut" for this. About a year after this operation he could pass

a No. 7 instrument, but has had occasional attacks of retention ever since.

On admission, he confessed that he had been drinking hard, and he was very much broken down. His bladder was greatly distended and very tender; no instrument could be passed; urine was forced out in a very small twisted stream, with great effort. He had frequent chills, alternating with profuse sweating.

A large poultice was applied to the abdomen; opium and belladonna were given by suppository; and he was put upon nourishing diet, with a certain allowance of stimulus.

On the next day, January 22d, Dr. Morton made a perineal incision and passed an instrument, which was felt in the hypogastrium. Pus flowed very freely. By a happy chance the catheter entered the bladder, and a very large quantity of urine was drawn off, to his great relief.

On the 23d the bladder was again distended, and the orifice could not be hit with the catheter. I recommended suprapubic section, to which Dr. Morton agreed, and asked me to operate, as he had a sore hand. I made a free incision in the median line, and laid open first an abscess cavity, then that of the bladder. A catheter was now easily passed from the suprapubic wound through the bladder into the urethra and out at the perineal opening. A drainage tube was substituted for the catheter, and left in place. Poultices were applied, and he was put upon opium and tonics, with liquid diet and stimulants. His condition steadily improved. Free drainage took place from the bladder, and in a few days carbolized oil was substituted for the poultices.

February 4. He has been feeling weaker for several days, his appetite has left him, and he is chilly.

On the 6th he was quite ill, with thirst, vomiting, a dry tongue and anxious face, sordes in the mouth, and high temperature. Ordered champagne.

On the 7th a mass of slough came away from the suprapubic opening. From this time he had no serious drawback.

The drainage tube was kept in until March 6th, when it was removed, and a catheter passed through the whole urethra and secured.

The wounds gradually healed, and on the 21st of April he was discharged cured.

Harry F., aged forty-three, was admitted into the Pennsylvania Hospital, April 28, 1886, with retention of urine, which, however; dribbled from him. He said that on the 24th he strained himself in trying to urinate, and had passed no water since. His condition on his entrance was very critical; the penis and scrotum were enormously swollen, the prepuce œdematous; the skin of the lower third of the abdomen was swollen, tense, and dusky red; the skin round the under surface of the root of the penis was purple, and on the eve of sloughing; the swelling had invaded the perineum.

I at once had ether administered, and made free incisions into the swollen tissues, giving exit to semi-purulent urine. I then exposed the distended bladder, and passed a trocar and canula into it; on withdrawing the trocar, an immense flow of urine took place. Enlarging the opening, I then substituted for the canula a rubber tube, putting a silk stitch through the side of this and the wall of the bladder. One silver wire suture was applied at the upper part of the wound, which was dressed with iodoform and carbolized gauze.

Next day, the symptoms being greatly relieved, I performed a perineal section, in doing so passing through an abscess cavity which seemed to surround the neck of the bladder.

The man did very well; on the 2d of May some sloughs came away from the suprapubic opening, and a silver tube was substituted for the rubber one. Exactly how long this rubber tube was kept in, I can find no memorandum, but it was several weeks.

On the 4th of June a small bougie was easily passed through the urethra into the bladder, and thereafter instruments of a larger and larger size were used until July 13th, when he was discharged, the canal readily admitting No. 11 of the English scale, and his urine flowing freely. I have seen him repeatedly since, in perfect health, and attending to an active outdoor business.

Mr. S., aged sixty-three, had suffered from enlarged prostate for several years, with frequent attacks of severe hemorrhage. He was a very large and stout man, well-nourished. I was called to see him in the country, August 13, 1886. His bladder was very largely distended, and he was in great suffering. An instrument could be passed only with extreme difficulty, and brought away no water, but clots of blood. The prostate was enormous.

He was etherized, and I performed suprapubic section, opening the bladder freely. The subcutaneous fat was very thick, and, of course,

the bladder lay very deep; yet there was no difficulty. A very large nodulated prostatic growth could be felt with the finger. Great relief was given by the operation. A tube was inserted, first of soft rubber, and then a glass one, as more easily kept clean.

On the 17th he was able to transact some very important business affairs. The great difficulty was to keep him dry and clean, as the capacity of the bladder was so reduced as to cause the urine to overflow continually. He was also much troubled by flatulence, and by the annoyance of using a bedpan. His strength continued to fail, and he died worn out on the 29th, sixteen days after the operation.

William E., aged seventy, was admitted into my ward at the Pennsylvania Hospital, April 24, 1887, suffering intensely from retention of urine. He had for many years had increasing difficulty in urination, from enlarged prostate; his feet and legs had occasionally been œdematous. On admission his bladder was distended as high as the umbilicus; his clothing was saturated with blood, which was still flowing from the meatus, as the result of strenuous efforts at catheterization made the previous evening. His pulse was weak and thready, and his mind confused. My colleague, Dr. Morton, saw him at the time, and thought the case so urgent that the resident surgeon, by his direction, at once performed suprapubic cystotomy. The wall of the bladder was found very dark, as if gangrene was commencing. A small incision was made, and a very large quantity of putrescent urine flowed away. Some large clots were removed. An exploration with the finger revealed a very large and hard bilobed prostate. A rubber tube was passed into the bladder through the wound, and a No. 10 silver catheter was passed by the urethra and left until the second day. The urine contained about one-half albumen, a good deal of blood, and some granular casts.

Great relief followed the operation, but it was found impossible to keep him dry, partly because of his restlessness. He wandered a good deal in mind after the third day, and passed into a typhoid condition, which terminated fatally on May 8, the fourteenth day after the operation.

An autopsy showed much thickened bladder-walls, and the prostate enormously enlarged, as well as altered in structure, apparently by cancerous deposit. The kidneys were enlarged, cystic, and seemed to have been the seat of chronic parenchymatous inflammation. The pancreas was very large and hard. No sign of peritonitis appeared.

The heart was hypertrophied, with atheroma of the mitral and aortic valves.

Another case was admitted on the evening of the same day. Richard W., aged forty, had gonorrhœa ten years ago. Has now double inguinal hernia, and double hydrocele. A year ago he was admitted with retention, but was then readily relieved by the catheter. On admission, he had passed no urine for fourteen hours, and was suffering greatly.

He was fully etherized, and catheterization attempted without success. I, therefore, performed suprapubic section under antiseptic precautions. A rubber tube was introduced through the wound, and connected with a urinal. He is doing extremely well, and passes some water through the meatus; but as no instrument can be made to enter the bladder, I propose, in a day or two, to perform perineal section, and probably extraduction, so as to restore the urethra. [This course was carried out. The perineal section being made, an instrument was carried into the bladder, and kept there for several days; extraduction was, therefore, not necessary. Urination took place freely by the lower wound and through the urethra; and the suprapubic wound quickly closed. The man is, at the date of this note (June 1st), almost well, the stricture of the urethra still, however, requiring treatment.]

My colleague, Dr. Morton, permits me to refer to the case of an old gentleman, upon whom I assisted him in performing suprapubic cystotomy on February 19, 1886. The patient was the subject of enlarged prostate, and had to have a catheter passed at intervals of not more than an hour, always with intense pain, night and day. A glass tube was left in, and unstopped from time to time. Greater relief than he obtained could hardly be imagined. He has lived a comfortable life ever since, gaining flesh and strength, and going out as much as at his advanced age is desirable.

I have assisted Dr. Morton in at least two other cases in which the benefit was well marked, but the patients had had less suffering, and retained less vigor of constitution. Both of these died within a week or two, with sloughing from infiltration of urine.

Now in looking back over this array of cases, it seems to me that the absence of evidence of peritonitis, infiltration of urine, and urinary fistula is very striking. In not one is there mention of troublesome hemorrhage encountered during the operation.

Let me say that I have personally examined the records wherever they have been accessible to me, and that cases quoted as second-hand are so noted. I am aware that there are other published accounts, but they have been beyond my reach.

I can recall to mind a number of instances that have come under my notice in former years, in which, from the results of the practice of suprapubic section above noted, I believe that it would have been attended with success; and I should certainly have performed it, had it then been among my resources.

Had time and space permitted, I should have been glad to give the details of a number of these cases of prevesical abscess, of enlarged prostate, of foreign bodies or tumors in the bladder. But I cannot doubt that almost every surgeon will have met with like experiences, and will be reminded of them by this brief mention. My own intention is to add no more to the sad list of such failures.

We may now consider the details of the methods of procedure in opening the bladder above the pubes.

I do not hesitate to declare that the fullest antiseptic precautions should be observed in these cases. Surgeons have asked me "What is the use of all this, when the urine will be flowing through the wound?" But in the first place, the urine does not, in the majority of instances, flow through the wound. And in the second place, if it does, it is rendered less irritating and less hurtful by being rendered antiseptic. Moreover, experience has shown me that the early healing and the prevention of suppuration thus secured have been of direct and striking benefit in the subsequent progress of the cases.

I therefore have the parts shaved and cleansed as carefully and thoroughly as for an amputation or for the removal of a tumor; the instruments and everything which comes in contact with the wound and surrounding region must be rigidly clean

and antiseptic; when the bladder must be distended, boric acid solution is used for the purpose.

As to the necessity of distending the bladder, most of the cases in which I have myself been concerned have not required any such preliminary, the organ being already in danger of bursting from the pressure of the contained urine. And it seems to me that the mistake may readily be made of throwing too much into it. One of the reasons given by Cheselden for his abandonment of the high operation for stone, was that he had seen the bladder burst, and Carpue says that the patients complained bitterly of the distress caused by the bulk of liquid which it was thought needful to inject. In these days of anæsthesia, our patients know nothing about any such annoyance; but may there not be even more danger, especially where the walls of the bladder are weakened by long-standing disease, of taxing them too severely?

I do not believe the operation is facilitated by such energetic distention; the bladder need merely be distinctly felt, and for this purpose f℥vj or f℥viij of boracic solution will be found amply sufficient. Especially is this true when the rectum is distended by f℥xij to f℥xiv of water thrown into the rubber bag.

With regard to the distention of the rectum, it seems to me there is less risk and more advantage. By thus preventing the recession of the bladder into the pelvis until all the arrangements for drainage are securely made, one possible source of embarrassment and danger is set aside.

In order to retain the fluid which has been injected into the bladder, Douglas, in 1719, had the penis compressed by flexion downward by the hand of an assistant. This seems to me preferable to the modern custom of tying a rubber tube or band around the root of the penis. In the female, should an operation of this kind be called for, the urethra can, of course, be readily compressed against the pubic bone.

By many writers (Chelius, Gross, Agnew, Sir H. Thompson, Keyes, and G. B. Browne) it is recommended that the bladder should be steadied by the hands of an assistant, when the incision or puncture is made. I cannot but think this not only needless,

but objectionable. The patient lies on an ordinary operating table, or in his bed, and the surgeon stands at his right, facing him. If the assistant stands on the other side, he is just as apt to pull the bladder out of place as to keep it steady.

The incision through the skin should be free enough to give ready access to the deeper parts. In fat persons, it must be about three inches; but when the abdominal wall is thin, two inches in length will suffice. When the cut is made exactly in the median line, no vessels of any importance can be encountered. The conjoined tendon being divided, the recti muscles present as a solid mass, and the interspace between them must be made with the knife or its handle. A layer of yellow fat comes next, and on cutting or scraping through this, the smooth dome-like shape of the bladder is seen at the bottom of the wound.

Before puncturing the bladder, it is very desirable to get control of it in some way, lest it should, as the urine flows away, collapse and settle back into the pelvis; the orifice made by the surgeon may then be very difficult to find, and it may be still more difficult to insert a canula. A small double hook, recurved and set at a right angle on a stem, has in my hands proved very convenient; it is applied to the wall of the viscus, exactly in the median line, and gives a very secure hold. A small tenaculum may answer much the same purpose, but its point may damage the operator's fingers. I have passed a double ligature, by means of a sharply curved needle, through the bladder wall, and held it by means of this.

When a large opening is to be made into the bladder, for purposes of exploration, the ligature is perhaps the best of these devices.

In cases of retention, the curved trocar and canula may now be at once pushed through the bladder wall, and the trocar withdrawn, leaving the canula in place, to be substituted later by a rubber tube.

The sonde à dard, an instrument of ancient date, like a staff, was formerly passed up through a perineal opening and made to thrust the anterior wall of the bladder; it has been revived

within a few years by Sir Henry Thompson, who, however, passes it into the bladder through the urethra. But if the exposure of the wall of the bladder has been effected as described above, this instrument is unnecessary. If the incisions have not been made, it is entirely possible for a fold of peritoneum to be engaged on the point of the sonde à dard, and thus to be cut through.

A curious proposition has been made by Duchatelet, and is quoted with approval by Villeneuve, that the opening should always be purposely made through the peritoneum, and thus, as he says, that "plasticity should be substituted for friability." Considering the fact that the danger of wounding the peritoneum has always been one of the strong objections to the suprapubic operation, it is only the boldest of the bold who would be likely thus to take the bull by the horns.

Having secured the control of the bladder, my own practice has always been to open it with a sharp-pointed bistoury close to the hook or ligature, making this orifice just about large enough to pass the tube which it is proposed to use. For purposes of exploration, it may easily be enlarged with a probe-pointed bistoury.

Von Antal has proposed to make an oval section of the muscular wall of the bladder, the long diameter of the oval parallel with the axis of the body; then holding the knife flatwise, he dissects off the included part of the muscular wall, exposing the bluish-gray translucent mucous membrane, which is to be divided vertically. Or he makes a vertical section first, and then introduces an elastic sac, which being dilated stretches out the edges of the orifice so as to admit of their being pared away. The sutures are carried through the outer and middle layers only of the bladder-wall, in order to avoid incrustation upon them; and the mucous membrane is supposed to act as a valve to prevent the escape of urine.

This procedure, which is certainly ingenious, is intended for sections made for the removal of calculi, when the bladder is to be at once sewed up. It might be applicable in other cases also, but could, I think, be simplified.

As to the proper point for entering the bladder, it seems to me that some of the older surgeons, in avoiding Scylla, steered into Charybdis. They were so afraid of injuring the peritoneum that they made the opening as low down as possible, and when the collapsed bladder sank, the orifice was carried down behind the pubis, so that the urine could hardly fail to find its way into the loose areolar tissue of that region, causing infiltration and all its attendant evils.

It seems to me that the proper point, as nearly as it can be indicated, would be about at the middle of the exposed portion of the wall of the bladder. This would be nearly in accord with Sharp's direction—an inch to an inch and a half above the symphysis pubis.

The next question is as to the arrangement for drainage. My own preference is usually for a soft rubber tube, of a length to be determined for each case. It should go well into the bladder even when this is collapsed, and should have lateral openings only near its inner or vesical end. It should be large enough to fill up the opening in the bladder wall without stretching it; and if it projects well out of the wound it can, if desired, be closed with a cork, or by means of a clip, or by bending its extremity double, and putting on a clamp of any kind.

I have twice used a glass tube with great satisfaction in cases of old men with atonied bladders. By means of a sheet of "rubber dam" slipped over the tube before its insertion, the patient can be kept perfectly dry, the urine being drawn off by a rubber tube into a urinal, or received in a mass of sublimated cotton, or in a large carbolized sponge. The glass tube is like that used in ovariotomy cases, but smaller, and curved in the arc of a large circle.

Metallic canulas may answer very well, in the absence of other tubes. Velpeau, writing at a period when rubber tubes were not to be had, declared the canule á demeure more dangerous in the suprapubic than in the rectal operation. He says of it: "Too long, it ulcerates the organ; too short, its tip, abandoned by the retracted bladder, becomes engaged in the surrounding tissues." In cases of enlarged prostate, it may

readily be imagined that any rigid tube, reaching the bas fond, might be a source of great irritation, its tip being continually rubbed against as the bladder expanded or contracted.

One or two writers have suggested the placing of the patient on his belly in order to favor drainage; but this would involve so much discomfort, and even risk, that I can hardly suppose the idea would be seriously entertained.

If a large opening has been made into the bladder, as for the purpose of exploration, the application of two or three catgut ligatures will suffice to close it around the tube. My own experience has been that here, as in cases of tracheotomy, the tendency of the wound is to heal quickly, except where the tissues, as well as the general system, are in a bad condition.

The edges of the wound in the skin can be apposed with sutures of catgut or silkworm gut, and, if necessary, a catgut suture can be passed through the wall of the rubber tube, and attached to the nearest suture, or to a strip of rubber plaster applied to the skin, and crossing the wound. Healing by first intention has taken place in several of my cases.

A few words only, in conclusion. My endeavor has been to examine fairly and without prejudice into the case for and against the suprapubic section of the bladder, apart from lithotomy; to trace the course of opinion with regard to it, and to ascertain how far the recorded experience of the profession is in support of that opinion.

It would seem that there has been a mixture of tradition and of a sort of superstition in the feeling with which this procedure has been generally regarded. If the dangers attributed to it were real, one would expect them to appear prominently in the histories cited. Yet, in fact, the proportion of absolute successes, so far as I can calculate them, is something over eighty per cent.; the failures about seven per cent., and the instances in which bad consequences were ascribed to the operation about eleven per cent. And looking at the cases in detail, it certainly seems to me that on all the counts of the indictment, danger of peritonitis, danger of infiltration of urine and urinary abscess, danger of urinary fistula, a verdict at least of "not proven" might fairly be asked for.

But it may be said that the other side is not heard; that the statistics of operations through the perineum and through the rectum should be given, and a comparison instituted between them and those now presented. My answer to this must be, that I am not concerned to advocate one operation more than another. Finding the suprapubic operation easy, available in very grave cases, and attended with good results in my own trials of it; regretting that it had not been earlier known to me as a resource, and believing that it has not met with the degree of favor it deserves at the hands of either writers or practitioners, it occurred to me to gather the evidence in regard to it for your inspection. I would say that it seems to me to be adapted to cases of retention from difficult stricture, especially with false passages, with prevesical abscess, or from traumatic cause; to cases of rupture of the urethra; to those of enlarged prostate with irritability, of tumors or foreign bodies within the bladder, and in some instances of intravesical hemorrhage.

The suprapubic operation does not by any means, in any case, preclude the perineal, as is shown in a number of cases cited in this paper. On the contrary, it often prepares the way for it.

One question I would ask: If the suprapubic section had been first tried and generally adopted, is it likely that the perineal operation would have been afterward preferred on account of its greater ease, simplicity, or efficiency?

It is a matter of satisfaction to me that the suprapubic operation, and my attempt at its defence, are now submitted to judges whose knowledge and experience must insure impartiality in their decisions, and leniency in their criticism.

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TO WHAT EXTENT CAN WE CLASSIFY VESICAL CALCULI FOR OPERATION?

With a Report of Cases and Remarks on the Different Methods Employed.

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Perhaps it may not be out of place for me to give a few of the reasons I have had in mind for presenting this paper.

I do not come from a stone-bearing section, but from a number of conversations held with my associate surgeons and friends in the profession, in my immediate neighborhood, I seem to have had rather more than the average number of cases, and the subject is one to which I have given much thought. There is no operation that affords me so much pleasure to perform as a clean lithotomy, and when I did my first Bigelow operation I regretted that it was to supplant so much that I had enjoyed in operative surgery. The number of my own cases is not so great that I come here to speak with authority. They do not present a run of successful recoveries, which is so much the laudable ambition of our surgical workers at present; in fact, I have much to regret that the mortality is as large as it is. I have a firm belief that if I had the work to do over, with my present knowledge, I might do much better. Again, I have reason to believe that my cases have been severe and serious in their make-up.

With all the progress we are still making in antiseptic surgery, and many other wonderful advances, I am yet strongly impressed that we must not lose sight of the firm-rock experience,

and with an honest desire that a full and frank discussion of the few points I shall present may result, and that one of the objects for which our Society was organized—the interchange of views and experiences—may be consummated, I proceed to give a short history of the more marked cases, following with a brief report of the different methods employed in this and other countries for the treatment of stone.

I might say that my first case was quite enough to discourage any one from ever getting much comfort in the thought of doing another like operation. In fact, it has been my severest case.

It will be observed that these cases present every variety of stone as to location in the bladder, prostatic, membranous, and spongy portion of the urethra, and that the kind as to formation of hard and soft calculi is singularly complete, while the extremes of large and small are seldom equalled.

Case I.—Lithotomy; lateral operation: death on tenth day. Weight, 2850 grains.

P. C., aged sixty-nine, flagman, correct habits, and health good till the present disease attacked him. Was first seen by Dr. U. G. Bigelow on December 22, 1868. He stated that for the past seven years he had been suffering from some disease of the bladder, and during the past three months had been confined to his bed most of the time. He complained of severe pain across the pubic region, extending through the fundus and neck of the bladder, also of a dragging sensation in the perineum. The pain in the neck of the bladder was notably severe after micturition. He complained, in addition, of much pain and an itching sensation in the glans penis. The bladder was quite irritable, the desire to urinate being frequent. Mr. C. was also troubled with obstinate constipation. He experienced much difficulty in passing his urine, especially when in a standing posture; the urine, at such times, being voided in two or three small streams, or drop by drop. This difficulty was somewhat avoided by lying on the side, though at times this expedient was but partially successful. The urine contained mucus streaked with blood; was alkaline; no casts.

Diagnosis: Stone in the bladder, with chronic cystitis, which a subsequent examination with the sound confirmed.

At this time his health was so poor that Dr. Bigelow did not think an operation advisable, and a plan of treatment was adopted to tone up

the system, and relieve cystitis. This was so far successful, that on May 3, 1869, he was removed to the Albany Hospital for operation. On the 4th, his condition being favorable, ether first, then chloroform was administered by Dr. Lansing, and assisted by Drs. Armsby, McNaughton, and Bigelow, I performed the lateral operation. The bladder was easily entered; the calculus was found in the infer or portion, just below the neck, and partially encysted. It could be grasped by the forceps without much difficulty. From the great size of the stone, it became necessary to enlarge the opening into the right and left lobes of the prostate. Considerable force was required in removing it. There was little hemorrhage following the operation. The patient came out of the anæsthetic nicely, although I had some fears in giving it, there being such a decided atheromatous condition of the arteries. The urine passed out from the wound within a few hours. Patient's condition was all that could be wished for till the third day, when he had a severe chill, but soon recovered from its depressing effects.

On the fifth day he passed his urine for a short time per urethram. During the morning of the seventh day he had another severe chill, and did not rally from its effects as nicely as before. The parts about the wound looked well, except slight sloughing near the rectum. On the eighth day, he was able to take freely of nourishment, quinine, and tonics, and seemed comfortable.

On the afternoon of the ninth day, when having his second passage from the bowels (the first occurred on the fifth day), it was noticed that fecal matter escaped through the incision, showing that extensive sloughing had taken place in and about the wound. The wound was well washed out with warm water, and he expressed himself as feeling much better. While sitting near a window, at the desire of his friends, in an easy chair, he was attacked with another chill, and died about 2 A. M. on the morning of the tenth day after the operation. No post mortem was allowed.

The calculus measured eight and one-quarter inches in its longest circumference, and six and three-quarters in its shortest. In composition the nucleus, the size of a large bean, was made up of uric acid, while the remaining portion was almost entirely oxalate of lime, exceedingly hard, and capable of receiving a bright polish.

CASE II.—Lithotomy: recovery. Weight, 240 grains.

S. L., aged twenty, unmarried, good habits, cartman by occupation,

born in America. Father and mother both living; two sisters dead. Entered St. Peter's Hospital July 7, 1874. Patient dated the beginning of his present trouble back some five or six years.

Drs. D. Stimson and E. R. Hun saw him three years ago, and then detected calculus; he was troubled, to a slight extent, with all the symptoms of stone. I saw him some time during the early part of this year, when the stone could be easily felt, but did not prevent his working.

On entrance into the hospital he was enjoying good health; his bowels were regular, appetite good, and he slept well, but was troubled with frequent micturition, with much pain when the urine ceased to flow. His urine was not bloody, had a specific gravity of 1.010, was acid, and of a pale, smoky yellow color. Chemical examination: clouded slightly by heat, cleared somewhat by adding acid. During patient's stay in hospital, before operation, he was given good diet, rest, flaxseed tea ad libitum.

On July 16th, assisted by the hospital staff, patient taking ether, I performed the lateral operation for the removal of stone, which was accomplished without any difficulty. The hemorrhage was slight.

Operation was performed at 3.30 P. M. At 7 P. M. patient was feeling comfortable; no pain, and inclined to sleep. At 8 P. M. had slept an hour; pulse 110, full, and quite rapid; temperature 98¼°. A male urinal was placed between his thighs to catch the urine which was escaping quite freely from the bladder, through the tube, and which was left in about three days.

The stone was oval in shape, weighing nearly four drachms; long circumference, three and three quarter inches; short, three inches. On sawing through it, the nucleus and dark lines were found made up of uric acid and various urates, and the white lines, together with the outer coating, of a variety of phosphates, mostly phosphate of lime.

This patient made an easy recovery, and was discharged from the hospital August 22d, cured.

CASE III.—Lithotomy, medio-lateral: recovery. Weight, 102 grains.

W. B., of Albany, aged two years and four months, born in America. Past history: Mother of child first noticed painful micturition in patient about August, 1874, which gradually increased in intensity, and was soon followed by all the subjective and objective symptoms of vesical calculus. This condition continued until the

winter of 1875, when he was examined by a surgeon, and the diagnosis of vesical calculus made. Entered St. Peter's Hospital May 14, 1875.

On May 15th, I performed the medio-lateral operation for stone, by aid of the rectangular staff. The angle of the staff was easily reached, and the knife passed into the bladder along the groove with perfect freedom. Urine escaped promptly. The stone was readily seized with small forceps, but a portion of it broke off; after considerable trouble it was removed. The bladder was thoroughly washed out with warm water. There was little hemorrhage from the incision; no drainage tube introduced. Patient came out of the ether very nicely; was removed to his bed, and bottles of hot water applied to his extremities, and flaxseed poultice over the region of the bladder. Allowed to drink freely of flaxseed tea. At 5.30 P. M. found patient much excited, and gave $\frac{1}{20}$th grain morph. sulph., and repeated it at 9 P. M.; urine escaping freely through the cut. Female nurse was directed to watch patient through the night, and repeat the morphine when necessary.

On June 10th he was discharged from the hospital, cured. Wound nicely healed; free flow of urine from urethra, unaccompanied by pain. Had gained in flesh. April 26, 1887, a fine healthy boy.

CASE IV.—Rapid dilatation of urethra by Heath's dilator; fragments washed out: recovery. Weight, 120 grains.

Mary S., of Cohoes, N. Y., aged four years, entered St. Peter's Hospital April 25, 1875. Father and mother living, also two brothers and one sister, all in good health. About two years ago her mother noticed that when she went to stool she cried, and complained that "it hurt her to pass water." In the winter of 1873 she got a little better, but in the spring of 1874 she began to get bad again, and continued to grow worse up to the time of her entrance into the hospital.

Patient came at 12 M. April 23d, and upon being etherized Dr. Balch detected the presence of a vesical calculus, and recommended her entrance to the hospital, preparatory to operation.

On April 25th patient was given a mild cathartic, which was followed by a good evacuation from the bowels. On the 26th, at 4 P. M., patient was placed on the operating table, and put under the influence of ether by Dr. Trego. Assisted by the members of the staff, I first dilated the urethra by means of Heath's dilator, sufficiently to introduce Mr. Tcevan's lithotrite; then, grasping the stone, proceeded to crush. The crushing of the stone occupied about fifteen or twenty

minutes. The bladder was washed out with warm water, and a large number of pieces of the calculus brought away. The ether was then discontinued, and patient removed to her bed. A large flaxseed poultice was applied over the hypogastric region, and flaxseed tea given. At 8 P. M. she was free from pain, but very much excited. Urine escaped freely on cloths.

May 3. Patient was discharged from hospital, to be brought back again in two weeks for examination.

19th. Patient was brought to dispensary, the mother having with her three good-sized pieces of the calculus, which the child had passed while at home. Her health was very much better, and the symptoms of which she complained when entering the hospital, had nearly disappeared. D d not have time to examine the bladder with sound.

June 25. The patient was put under the influence of ether, and several pieces of the stone detected, which were removed by means of small forceps. From this time she made a rapid recovery, all symptoms of vesical irritation entirely disappearing.

CASE V.—Lithotomy, medio-lateral: recovery. Weight, 480 grains.

B. McD., aged forty-five years, married, father of three children; oldest aged five years, youngest five months. Habits good; a very hard worker; resident of Albany County. Eight years ago last spring, while attending the raising of the frame of a barn, he was suddenly attacked with nausea and vomiting, and some pain in the right lumbar region; the latter was not very severe. Toward evening of the same day, he noticed blood in his urine, which at times was quite free, and continued for three days. From this time on until I saw him, nearly two years ago, he had had constantly increasing symptoms of stone in the bladder. June, 1874, I introduced a Thompson steel sound, which gave him great pain, and though permitted to make but a partial examination, yet did not detect a stone. In February, 1875, Dr. Morrill again introduced a sound, but with the same result.

December 9, 1875. I determined on making a more thorough examination. His symptoms of stone being so positive, I felt we must have erred in our previous examinations. He was compelled to pass his urine now, as often as every quarter or half hour, at times passing blood; again the stream would stop suddenly, giving him intense pain; little rest at night, and constant pain in glans penis; little if any relief had been afforded by the treatment of the past two years.

Without very severe pain, I succeeded in introducing a Thompson

catheter staff, with a very short curve, and with my finger in the rectum, raising the bladder behind the prostate gland, readily detected what seemed to be a good-sized stone. On being told of his trouble, he at once expressed a desire to have an operation performed, and in a week presented himself for operation.

The urine was of mahogany color, and gave an acid reaction, with specific gravity of 1.020. Chemical examination showed considerable albumen, and microscopical examination showed pus, blood, and uric acid crystals in abundance. He was somewhat emaciated, and for the past six months had been indulging freely in alcoholic stimulants to afford relief from pain.

18th. Bowels having been freely moved, I performed the mediolateral operation. Patient was a long time in coming under the influence of ether, but the operation was of short duration. On introducing the rectangular staff, there was some escape of blood. Following the removal of the stone, a quantity of pus and blood escaped, the bladder being somewhat roughened and ulcerated.

The stone weighed one ounce; long measurement, four and a half inches; short measurement, three and seven eighths inches, and was made up principally of phosphates. There was no bleeding at the time of the operation, but as he reacted from the anæsthetic the bleeding became somewhat severe, and it was thought best to introduce the rubber canula with the compressed sponge about it. This soon controlled all hemorrhage; stimulants with carbonate of ammonium were given quite freely, and by 4 P. M. his condition was as good as could be desired. Urine mixed with blood escaped freely through the canula. An anodyne was given at bedtime, and two drachms of whiskey were ordered every two hours during the night.

19th. Passed a comfortable night, pulse 96, temperature normal, no sickness at the stomach, no bleeding from the cut. Urine flowed freely through canula; was relieved of all his old painful symptoms, and said he was very comfortable. Stimulants and beef tea ordered for the day. 6 P. M., had passed a comfortable day, condition about the same as in morning, had slept some; treatment continued. From this time he made a rapid recovery.

January 10, 1876. Wound entirely healed, and to-day he took a walk out; no unpleasant symptoms.

12th. Discharged cured, intending to-morrow to return to his home in the country; visited the office on foot.

January 20, 1887. Patient has remained well since the operation. Wife has borne two children since.

CASE VI.—Rapid dilatation of urethra; removal by forceps: recovery. Weight, 60 grains.

Mrs. W., widow, aged thirty-three, had suffered for four years with decided vesical symptoms of stone, the diagnosis being confirmed by an examination with the sound.

Case under care of Dr. U. G. Bigelow. On May 11, 1885, while under the influence of chloroform, administered by Dr. B., I dilated the urethra and removed a phosphatic calculus the size of a large filbert, together with many fragments. The after-treatment consisted in washing out the bladder daily, the free use of demulcent drinks, tonics, together with hyoscyamus, uva ursi, pareira brava, and small doses of opium. In two weeks she made an excellent recovery.

About the middle of September of the same year, she complained to Dr. Bigelow of her old symptoms. The old treatment was tried, but not giving sufficient relief, on October 14th we again, while the patient was under the influence of an anæsthetic, dilated the urethra, and removed two small phosphatic calculi. After this she improved nicely, and has been comfortable ever since. No marked return of her old symptoms yet. She has occasionally suffered from slight cystitis. Since seen frequently and entirely well. July 10, 1886, remaining well.

CASE VII.—Rapid dilatation of urethra; exploration of bladder with finger; phosphatic encrustation; bladder washed out: recovery. Weight, about 90 grains.

Mrs. W., married, aged twenty, mother of two children. Had good health up to three years ago, when she first observed trouble in urinating, and occasionally passed a fine white sandy-looking substance; also some blood. Has received treatment almost constantly since.

May 2, 1874. I first examined her bladder, but could not detect calculus. During the next year, she at times received benefit from washing out the bladder. Took Bethesda water, also Saratoga Star Spring water, and the usual bladder medicines. Thought she derived more benefit from ten drops of tincture of iron, with five drops of diluted sulphuric acid in a wineglass of water, after each meal. After taking this mixture for a few days, she would at times pass freely of the fine white sandy deposit. On May 4, 1875, improvement not pro-

gressing satisfactorily, while under the influence of ether, administered by Dr. Snow, I dilated the urethra sufficiently with Heath's dilator to pass my index finger into the bladder, and on the left side I detected a rough coating of the mucous membrane, and succeeded in bringing away a number of small pieces of phosphatic calculus. The bladder was now washed out, and the patient placed in bed. No unpleasant symptoms followed. The urine dribbled from the bladder for about four days, when she regained perfect control over it. She made an excellent recovery. January, 1876, occasionally passed some of the white sandy substance, which I am inclined to think came from the kidneys. She could now retain her urine three or four hours, while before it was impossible for her to leave home, being compelled to urinate every half hour or so. October 1, 1882, I have seen this patient often since the operation, and she has remained thoroughly well.

CASE VIII.—Large calculus; rapid dilatation of urethra; lithotrity and washing out of the fragments: recovery. Weight, 328 grains.

Mrs. Y., aged sixty-five; married, and the mother of five children. She had an attack of renal colic fifteen years ago, and at that time passed several small calculi, but recovered entirely. Three years later she had another attack, since which time she has suffered all the symptoms of vesical stone with chronic cystitis. I saw the patient January 18, 1877, with her family physician, Dr. Werner, of Cobleskill, N. Y., who had previously diagnosed vesical calculus. On sounding the bladder it was evident that there was a large stone present. For the past year she had been obliged to push it back with a silver female catheter whenever she desired to urinate. A previous examination of the urine showed the kidneys to be healthy. The patient was operated upon on the 18th of January, Teevan's lithotrite being used. I crushed several times, and washed out with a Davidson's syringe; first, however, dilating the urethra with Heath's urethral dilator, so that I could introduce the index finger of my right hand. The operation lasted nearly an hour, the patient bearing the ether only fairly well. My first impression was to do a vaginal lithotomy, so well spoken of by Dr. J. Collins Warren, of Boston, but the patient was so very fleshy as to make it quite impossible to reach the parts. The stone was phosphatic in character, and the detritus weighed 328 grains. A distinct nucleus was found, probably a renal calculus. Some of the detritus was lost in a basin of water that was overturned.

During the afternoon after the operation, the patient suffered from a severe pain in her back, and also vomited. The vomiting, however, was soon controlled. On the morning of the next day, January 19th, she was feeling comfortable, her skin was moist, and her pulse 92. She controlled her urine readily, although its voiding was attended with smarting and burning. She slept well, passing, indeed, a comfortable night, and from this time progressed to a favorable recovery. Discharged cured January 27th. Four years after was in good health, no bladder symptoms.

CASE IX.—Renal colic; stricture of urethra; calculus lodged behind stricture; internal urethrotomy; removal of stone: recovery. Weight, 41 grains.

J. R., aged thirty-six, a wood-cutter and guide in the North Woods. Admitted to St. Peter's Hospital in December, 1876. History: Twelve years ago he contracted gonorrhœa, and was a long time in getting well. Nearly three years ago he had an attack of left renal colic. Soon after he experienced increased difficulty in passing his urine, the stream being at times much reduced in size. About six months later he discovered and could feel a hard substance in the perineum, and from that time on he had serious trouble in emptying his bladder. For the past few months he had been unable to work. By the use of bulbous bougies two strictures were detected, one about two inches down in the spongy portion of the urethra, the other in the membranous portion. Through the second stricture only a whalebone guide could be passed, and its passage revealed a calculus in the membranous or prostatic portion of the urethra. The calculus could be felt from without. His urine was examined, but revealed no organic disease of the kidneys. He was given five grains of quinine three times daily, and ten minims of tinc. ferri chloridi for two days, and on December 18th was put under the influence of ether. The stricture two inches down the urethra was divulsed by an Otis's urethratome, then a guide was passed through the lower stricture, upon which was passed a Maisonneuve tunnelled instrument, and the stricture cut. Thompson's long slender urethral stone forceps were now easily passed down the urethra, and this stone removed, oblong as you see, measuring in its long diameter one inch, and in its circumference three-fourths of an inch, and weighing 41 grains. It is made up of oxalate of lime with a crust of the phosphate. The patient had a chill a few hours after the operation, but by the aid of full doses of quinine

and iron, he went on to a perfect recovery. The strictures were treated by passing full sized steel sounds twice a week. A subsequent examination of the bladder with Thompson's short-beaked searcher was made, but nothing was found. To facilitate removal of the stone, it became necessary to incise the meatus slightly.

The patient was discharged cured March, 1876. February 1, 1877, I had a letter from him, saying that he had remained perfectly well. No return of strictures.

CASE X.—Calculus in a girl; rapid dilatation practised, and stone removed entire: recovery. Weight, 40 grains.

July 21, 1879, I was requested by my friend Dr. Barker, of this city, to see Miss W., aged five years, who had been suffering nearly two years with a bladder trouble. I found her in bed, with her clothing wet. Her mother stated that the child was passing her water constantly, and with great pain, and that it was impossible to keep her dry.

On sounding the bladder a stone was felt. She was given two grains of quinine three times daily, and an anodyne night and morning. On July 23d, we proceeded to operate. Chloroform was administered, and the urethra quickly dilated with Heath's dilator, and with a small stone forceps this calculus, weighing forty grains, was removed. It is composed of oxalate of lime, and, as you observe, is covered with numerous little spines, which must have caused great pain. Quinine was continued, and also demulcent drinks, and I am informed by Dr. Barker that the little patient went on to a rapid recovery. Two years later she was in excellent health.

CASE XI.—Large prostatic urethral calculi removed by external perineal incision. Weight: large, 475 grains; small, 210 grains. Recovery.

A. F., aged nineteen, was admitted to the Albany Hospital March 29, 1879, as a case of urethral stricture. History: Ever since his third year the patient had been troubled with painful micturition; a burning, stinging sensation being experienced just after the act. He had also been compelled to get up two or three times during the night to pass urine. He denied ever having had gonorrhœa. On examination it was found impossible to pass any instrument on the first trial, and as the attempts gave him great pain, it was decided to wait and anæsthetize him, and then make the examination a thorough one.

The perineum was enlarged, as was also the inferior wall of the urethra along the lower half of its course. Hot applications were made to the parts, covered with oil silk. On the 5th of April the patient took at 10 A. M. ten grains of quinine, and at 12 M. was etherized. An exploration of the urethra detected calculi. A grooved sound was then passed and an external perineal section performed, the incision being about one and a half inches in length. By the aid of the sound, the fingers being introduced into the rectum, a large, smooth calculus was expelled from the cut, which was directly followed by a second one. The wound was left to itself, a little lint being applied to soak up the oozing of blood. Hemorrhage was slight. The patient was placed in bed, wrapped in warm flannel, and kept under quinine. April 26th symptoms of cystitis were noted. I ordered a warm sitz bath and a prescription of potass. bicarb. and hyoscyamus. May 19th the patient was etherized, and Nos. 10 and 16 English steel sounds were passed. June 9th the patient was discharged, cured. He was ordered to have full-sized steel sounds passed at least once a week for two months.

The calculi are mostly phosphate of lime. It will be observed that the larger one is a perfect cast of the distended prostatic portion of the urethra, even presenting the impression of the opening of the ducts, and that the facet of the junction of the two stones at the greater curvature of the urethra is very perfect. These are remarkable specimens of prostatic or urethral calculi, and undoubtedly were lodged there when the boy first presented symptoms at the age of three years. Since seen, and in excellent health.

Case XII.—Piece of chewing gum introduced into the bladder; removal by Bigelow's operation: recovery. Weight of fragments, 49 grains.

A. S., aged twenty-four, single, was admitted to the Albany Hospital September 5, 1879, and the diagnosis of foreign substance in the bladder made. Six weeks before coming to the hospital the patient had introduced a piece of chewing gum into his bladder. He had been treated, but without success. On September 7th the searcher, a steel sound with a short curve, was introduced, and the foreign body felt.

The next day a consultation of the staff was held, and on again using the searcher the substance was felt; but when the lithotrite was introduced into the bladder nothing could be found. On the morning of September 9th the patient had a severe chill. Cinchonidinæ

sulph. was freely given, and continued in two grain doses every two hours. September 13th the searcher was again introduced, and the body could be distinctly felt; indeed, an audible click was emitted by the incrusted salts of the urine. On the 14th he had another chill. On the 17th the patient was put under ether, and with the lithotrite pieces of the salts incrusted about the gum were brought away. Bigelow's evacuating tube, No. 29, was then introduced into the bladder, and his suction apparatus, filled with water, was attached. The water was gradually forced into the bladder, and, as it returned, the gum came with it, thus making the operation a complete success. The patient was put to bed and ten grains of quinine given. The cinchonidia was continued as usual, two grains every four hours. About 11 A. M. September 18th he had a severe chill. Ten grains of quinine were administered, and warm applications made. At 8 P. M. another chill occurred. His temperature was 105°, pulse 150, and perspiration very profuse. After the 18th the patient had no chills, and his improvement was continuous up to the 24th, on which date he was discharged cured.

CASE XIII.—Large phosphatic calculus; cystitis; great amount of pus in the urine; medio-lateral lithotomy: recovery. Weight of fragments, 240 grains.

Henry M., physician, aged forty-two. Two years last October, while visiting a patient during a rainstorm, he caught cold and had an attack of acute cystitis. His professional duties did not allow him to recover completely before he again went to work, and he thinks riding made the trouble worse. At times he had been troubled with spasm of the bladder, making it necessary to pass a catheter. The passing of the catheter upon these occasions, however, was attended by a pain so intense as to necessitate the administration of chloroform previous to the introduction of the instrument. At times, also, there had been a great deal of pus and mucus in his urine, and its condition was so acid as to scald severely on passing it. To relieve the burning, he was in the habit of taking alkalies, also morphia and chloroform. He further complained of considerable pain in the end of his penis. On October 12, 1879, the patient was put under ether, and the urethra and bladder examined. A number of strictures were found in the urethra. An Otis's instrument was passed, and the stricture in the spongy portion cut. One or more deeper down were of large calibre and admitted a No. 2 sound. A Thomp-

son's searcher was passed into the bladder, and a calculus of quite large dimensions was found. With the lithotrite it seemed to be over two inches in length and more than an inch in its shortest diameter. The patient was then allowed to come out of the anæsthetic and was given five grains of quinine. Having a slight chill at 6.30 P.M., three grains more of quinine were given. This was vomited, however. At 9.30 P.M. the patient was doing nicely. October 18th, the patient was put under ether, and the medio-lateral operation for lithotomy, by the rectangular staff, was done.

Owing to the size of the stone, it was found necessary to crush and remove it in fragments. Length of operation forty-five minutes. After the operation, the hemorrhage became rather free, and the patient was again put under ether and another ligature applied, which, in addition to plugging the wound with the chemise, controlled the bleeding.

The plug was removed October 19th, the patient doing nicely and passing urine through both urethra and wound. On October 31st, the urine passed entirely through the urethra. Nearly one-third was pus and mucus. On November 4th, the urine was passed nearly clear. On this date a catheter was passed, after which urine escaped from the wound for a short time. Patient continued taking twelve grains of quinine in twenty-four hours. On the 7th, the patient came down stairs for the first time since the operation, and on the 8th he attended a clinic. At this time he was troubled with incontinence of urine. His pulse and temperature were normal, and he was feeling well. On the 14th, he was up and moving about the hospital. Could hold his urine for two or three hours at a time. Pus had nearly disappeared from the bladder. The bladder was washed out daily. On the 18th, the urine appeared normal. On the 22d, a stricture two and three-quarters inches from the meatus was cut with Otis's instrument. On December 3d, the patient was discharged cured, and returned to his home.

The stone weighs 345 grains, and could easily have been crushed and washed out by the Bigelow method, but in consequence of its size, and of the severe cystitis, it was thought best to cut.

CASE XIV.—Large phosphatic calculus; Bigelow's operation (litholapaxy): recovery. Weight, 348 grains.

C. H., aged sixty, was admitted to the Albany Hospital May 26, 1880. About eighteen years ago he began to experience burning

sensations in the urethra when passing water, which continued intermittently (though not sufficiently unpleasant to cause any particular annoyance) up to about four years ago, at which time, after riding over rough roads, he had an attack of hemorrhage from the bladder, lasting for a short period. These hemorrhages occurred regularly every two or three weeks up to about two years ago. At the time of the first attack of hemorrhage he had severe pain in the lower portion of the left lumbar region, which lasted for two or three days, and required large doses of morphia for its relief. Upon his admission to the hospital, an examination with a sound was made, when a calculus was both distinctly felt and heard. He was now given ten grain doses of potassium citrate three times a day. On May 29th, he was anæsthetized and a lithotrite passed. After exploring the bladder for some little time, the stone was finally engaged and crushed. The Teevan and Thompson lithotrites were used alternately. The instrument was then withdrawn and litholapaxy practised, bringing away considerable detritus. I used in this operation, as well as my other, Bigelow's original instrument. (At this time the rubber bag became loosened from its attachments, unfitting the instrument for use. I was, therefore, greatly indebted to Dr. Van der Poel, Jr., for the use of his improved Bigelow apparatus.) The foregoing operations were done consecutively several times, until the bladder was quite free from foreign matter. Patient was taken to his room and ten grains of quinine were given. He vomited before fully recovering from the effects of the ether. The first night following the operation he had a chill, the temperature afterward rising to 102° F., and dropping by the third day to 99.5°. On the afternoon of the third day, he had a second chill, followed by a temperature of 101.5°, which declined again by the fifth day. The patient was now given five grain doses of quinine, three times a day. On the seventh day he had a chill, followed by a temperature of 103.6° at which time one-quarter drop doses each of tinct. aconite and tinct. digitalis were given every hour; the temperature fell next morning to 101°. By the eleventh day it had reached normal, remaining so with slight exacerbations, until the evening of the fifteenth day, when, having had another chill, it rose to 103°. On the 1st of June he was ordered to take triticum repens. On the 11th of June he was put on tinct. gentian. comp. On the morning of the sixteenth day the temperature dropped to 101°, but on the same day, after a slight chill, it again reached 103°. On the seventeenth day it fell to 99°,

rising again to 101° in the evening. On the morning of the eighteenth day the temperature was normal, but rose in the evening to 101°. On the nineteenth day he had a severe chill, which sent the temperature up to 103.5°, falling, however, next day to 102°. On the twenty-first day it rose to 103.6°, falling gradually by the twenty-third day to 99.5°, but that evening another chill caused it to rise to 102.5°. By the twenty-fifth day it had declined to normal. On the twenty-seventh day he had a slight chill, with but little rise of temperature, which dropped again to about normal, and so remained until the day of his discharge, June 30th, when he expressed himself as being in a much better condition, both physically and mentally, than he had been for years. On July 13th I received a letter from the patient's family physician, Dr. Merritt, in which he stated that the patient had had a relapse as a result of over-exertion, but at the time of writing he was much better and able to be about, and with proper care there was no doubt that he would be as well as ever. Soon after, I had word from the patient that he was entirely well, passing normal urine in a natural manner, and again attending to business.

The detritus weighs 380 grains and is entirely phosphatic.

CASE XV.—Small phosphatic calculus; Bigelow's operation, with rapid recovery. Weight of detritus, 60 grains.

R. S. P., aged fifty-three, was admitted to the Albany Hospital September 15, 1880. About three years ago patient first noticed that he could not pass water as readily as usual. This slight impediment to the emptying of his bladder remained awhile, and then there gradually came a feeling of weight, and a dragging pain in the region of the bladder, also pain radiating up the track of the ureters. About eighteen months since, while urinating he noticed that a bloody discharge was coming from him. This, however, was the only time that blood ever passed. He has complained of pain on passing water ever since he first noticed that something was wrong. For the past three months he has had to draw his water by means of a catheter. He had never suspected the nature of his trouble until recently, when, on sounding him, I discovered a calculus of small size, and suitable for the operation of litholapaxy. This operation was performed September 18th, and a number of fragments of a phosphatic variety were removed. His temperature on the evening following the operation was 102° F., and pulse 100. These fell the next morning, the temperature to 99°, and the pulse to 80. The evening of that day (19th), how-

ever, they rose, temperature to 101° and pulse 85, falling again to 99° and 70 respectively. After this, for a few days, the temperature was between 99° and 100°. No chill after the operation. Urine was drawn as required. About eight days after the operation the bladder was washed out and sounded, but nothing was found. After this time the washing was continued once a day, nothing but a little mucus making its appearance in the urine.

The patient was discharged October 2d, having been in the hospital nineteen days, and only fourteen after the operation. Later he came to my office, saying that he was feeling well, and could pass his urine in a natural manner. None of his old symptoms were troubling him. On sounding the bladder it was found free from any deposit. This case is remarkable in that retention of urine coexisted with a stone in his bladder.

CASE XVI.—Attempted litholapaxy; probable tumor of the bladder: death. Weight of detritus, 30 grains.

J. B., aged thirty-three, married, native of the United States, Rock City Falls, N. Y. Admitted to the Albany Hospital January 25, 1881. No history of stone in other members of family. When patient was sixteen years old he was troubled with a painful burning sensation in the penis while micturating. This was sometimes so severe as to compel him to stop work. Patient also had pain in back, aggravated by exercise. These pains would last a few days or weeks, and then he would be free from them for a short time, when they would again return. This condition lasted for about two years, when he was not again troubled for four or five years. At the end of this time he was attacked with renal colic. Acute parenchymatous nephritis followed, lasting for nine weeks. During this time urine was about thirty per cent. albumen. Patient recovered from this attack, but was not free from lingering pain across the back.

Four years ago patient had a second attack of nephritis. At this time the urine was ninety-five per cent. albumen, with brick-dust deposit. This lasted for six months, pus making its appearance in the urine. Patient partially recovered from this.

August, 1880, patient was taken with severe, burning, dragging pain in the region of the bladder, with pain in end of the penis; also, pain on micturating increasing in severity. Now flow of urine suddenly stopped while urinating. With Thompson's searcher a small calculus could be felt. Examination was followed by free hemorrhage. Hemor-

rhage from bladder continued, clots of blood passing with urine. Pain radiated up ureters. Examination of urine showed albumen, but no casts. Ether was given. On introducing the lithotrite, it caught a small stone which broke readily, but the instrument became apparently entangled in the coats of the bladder, and was withdrawn. On washing out, about thirty grains of oxalate of lime detritus were secured. Chills ensued, followed by suppression of urine and death. No autopsy allowed.

CASE XVII.—Litholapaxy attempted; detritus too great to wash out; lithotomy, lateral: death. Weight of detritus from litholapaxy, 340 grains; weight of detritus from lithotomy, 750 grains.

T. B. F., aged thirty-eight, married, born in America, carriage-maker, Cobleskill, N. Y. Admitted to the Albany Hospital June 25, 1881. Family history good. About fifteen years ago, patient noticed a slight yellow discharge from penis, but denied having had gonorrhœa. Soon after, while passing water, the stream suddenly stopped, but on moving about started again. He tried many kinds of patent medicine, but did not apply to a physician until six or seven years ago. Since that time he has suffered somewhat during the act of micturition. He has not been able to work for three years. Attempts to pass an instrument have failed on account of extreme irritability of bladder and urethra. Urine contained pus and albumen, but no casts. June 26th, patient was put under the influence of ether. The catheter sound passed readily, striking stone in the bladder. Bladder was then injected through it. The Bigelow lithotrite passed readily, a stone being grasped which measured on scale of instrument one and a quarter inches in diameter. Stone was cracked and instrument withdrawn. The Thompson lithotrite was then inserted, but the fragments repeatedly slipped from the jaws of the instrument. The Bigelow was again inserted, with which the stone was crushed. A stricture of the spongy portion of the urethra was divided with Otis's urethratome. The Thompson catheter staff was used, and bladder again injected. The evacuating tube was passed, and receiver was filled with small pieces of stone. Sound was again passed, and another large and hard stone detected. After several attempts to crush and remove stone, lithotomy was decided upon. Operation most successful. Many pieces removed. Bladder washed out with warm water. Patient was put to bed; morphia, whiskey, and milk given, and quinine, five grains, three times a day. Vomited once, checked by morphia one-fourth

grain every four hours, with bismuth and carbolic acid. Poultice over abdomen, afterward changed to hot-water dressing. Vomiting returned with hiccough, which was checked by hydrocyanic acid, bismuth, and champagne. Diet: milk, lime-water, toast, and beef tea. Patient died July 3d.

Post-mortem examination held July 4th. Body much emaciated; some peritonitis and marked pelvic cellulitis. Bladder was adherent to rectum. Abscess in front of bladder, and in walls of bladder itself. The suprarenal capsules were adherent. A phosphatic deposit was found in the pelvis of the right kidney, the left being normal. Incision almost healed.

CASE XVIII.—Lithotomy: recovery. Weight, 71 grains.

D. W., aged sixty-two, married, native of United States, farmer, Fairfield, Herkimer Co., N. Y. Admitted July 2, 1881. An attempt was made July 11th, to crush stone, but the presence of instrument caused so much pain and spasm of bladder, that after two or three attempts to grasp the stone it was deemed advisable to abandon the attempt. Patient discharged July 11th, improved.

Patient returned October 27th, and lateral lithotomy was performed. Was discharged November 3d, much improved, and when heard from a year later was in good condition.

CASE XIX.—Lithotomy, lateral; large stone: death. Weight, 2880 grains.

F. C., aged fifty-seven, native of Canada, axemaker, Cohoes, N. Y. Admitted to Albany Hospital September 19, 1881. Patient had had trouble when micturating for several years, suffering much pain for the last two years. Urine contained pus, but no casts. Sound was passed and a stone discovered. It was thought best on consultation of staff to perform lateral lithotomy. Stone was removed entire. Very little hemorrhage followed. Patient was put to bed and given morphia and whiskey, with cans of hot water to back and feet. Had chill on same day of operation. Whiskey and quinine were given freely, four ounces beef-tea per rectum at night. Chill was followed by a temperature of 103°, pulse 154. Vomiting came on. Respiration spasmodic in character. Patient died suddenly September 23d. No autopsy permitted.

CASE XX.—Litholapaxy: recovery. Weight of detritus, 60 grains.

J. C., aged forty-two, married, native of United States, mechan-

ical engineer. Family history good—father and mother living. Residence, Schenectady, N. Y. About four years ago patient first noticed that in passing his urine the stream stopped suddenly, and a severe pain set in which lasted about two hours. After this he noticed nothing unusual for over a year, when the stream again stopped suddenly. Since that time he had been troubled more or less, and to pass his urine had been compelled to adopt a position on both hands and one knee, the other leg being straightened out behind him. At times a scalding pain was felt in the end of penis. For the last two years he had been troubled with prolapsus of the rectum, and for the relief of that he had used an injection of water every day. His general condition was good. I saw him August 1st, and detected a stone in his bladder. He entered the Albany Hospital October 6th, and was again examined, and the stone distinctly felt with the sound by myself and Dr. Snow. He had been taking for some time quinine sulphate gr. j, t. i. d., and an occasional cathartic had been given, as his bowels had been rather constipated for about two years.

On October 7th, he was etherized by Dr. Snow, and employing the Bigelow method, I removed this specimen of stone in eleven minutes. Patient began to improve at once, and on October 15th, eight days after the operation, he was able to walk down to the operating room. His urine was clear, bladder did not require washing out. He went on to rapid recovery in every respect, leaving hospital on eleventh day after the operation.

Case XXI.—Litholapaxy, second operation: death on third day. Weight of detritus, 380 grains.

C. H., aged sixty-five, married, native of United States, travelling agent, Cherry Valley, N. Y. Admitted October 6, 1881.

July 7, 1881, while watering a horse, the animal squeezed patient about the pelvis, and he was sure that at the time his bladder was in some way injured. No bloody urine passed. October 8th, patient was etherized, and employing the Bigelow method I removed a large quantity of stone. Evidently there was more than one crushed. The operation lasted one hour and ten minutes. Patient recovered from anæsthetic, and at 3.30 P.M. was given a hypodermic of one-quarter grain of morphia, and a poultice was placed over the hypogastric region. Was given as much milk as he would drink, and at 5 P.M., about four ounces of urine were drawn. He then slept well for about two hours. At 11.50 P.M., two ounces of urine drawn off. Rested

quietly till 5 A.M., when he passed one-half ounce of urine, also at 7 A.M. At 8.30 A.M., one and one-half ounces of urine drawn. At 10.45 A.M., one-half ounce of urine passed. At 10.50 A.M., took ℥jss spts. frumenti. 11 A.M., glass of milk. 1 P.M., dose of citrate of potash. 2.15 P.M., glass of milk. 4 P.M., dose of citrate of potash. 4.30 P.M., drew off one-half ounce of urine. 7 P.M., took dose of citrate of potash. Patient then slept for an hour. At 8 A.M., fresh poultice was applied. At 9 A.M., took quinia, grains ij, and swallowed poorly. One and one-half ounces of urine drawn and hot water applied to extremities. Was bathed in alcohol also at this time. Pulse 132. At 9.50 P.M., one ounce of milk. 10.25 P.M., whiskey. 10.35 P.M., milk. 10.50 P.M., milk. 11.05 P.M., hypodermic of arom. spts. ammon., ♏ xij. 11.25 P.M., milk. 11.35 P.M., whiskey. 12 P.M., milk and fresh poultice. 12.20 A.M., quinia and whiskey. 12.40 A.M., milk. 1.20 A.M., respirations very much labored. 2.25 A.M., whiskey and quinia; pulse 160, respiration 28. At 2.45 A.M., hypodermic of whiskey and ammonia; he began to raise a thick, dark colored fluid, and breathing became more labored; pulse 160, respiration 33. At 3 A.M., drew off two ounces of urine. 4 A.M., hypodermic of whiskey and ammonia. At 4.15 A.M., vomited a dark colored material, and soon after died.

This patient, it will be remembered, made a good recovery from his rapid lithotrity on May 29, 1880, and stated that he remained well and in good health in all respects, able to ride over rough roads, until July 7, 1881, when he was injured. Is it possible that the accident may have loosened some sacculated stone or stones, and brought on all his old symptoms? When he came to my office to see about the last operation, he was very much depressed. His business had gone badly, and the thought of another operation discouraged him very much. From this feeling he did not rally, and after the operation showed no disposition to get well, and did not cheer up in the least. He was content to die, and so expressed himself.

Autopsy twenty-four hours after death. Body well nourished; no peritonitis; fundus of bladder attached to peritoneum; old adhesions at juncture of large and small intestines. Colon bound down. Appendix normal. Small intestine also bound down. Right kidney enveloped in large amount of fat and capsule peeled off easily. Both kidneys were contracted and exhibited a condition of suppurative nephritis. Ureters dilated. Quite extensive recent adhesions of bladder to peritoneum. No effusion into abdomen. Rectum ad-

herent to bladder. Prostate gland enlarged. In anterior wall of the bladder was a large sac where stone had lodged. Thorax and brain not examined.

CASE XXII.—Litholapaxy. Weight of detritus, 300 grains. Later, lithotrity: recovery. Weight of detritus, about 40 grains.

J. L. C., aged thirty-one, native of United States, clerk. He was a patient in the hospital in 1870 for treatment of acute gonorrhœa. In 1873, he noticed his stream of water grow smaller. In 1879, while in Portland, Oregon, he had an attack of retention of urine, and the stream stopped completely. The physician who treated him, first used the catheter and then passed a sound, after which he felt better. In October of the same year he was operated on, and the stricture of the urethra cut. He thought he had a stone in the bladder at that time. He had his bladder washed out regularly for two months. For three months before coming to Albany he had been confined to bed. October 10th, his bladder was examined, and a large calculus found. September 14th, the bladder was injected and the stone crushed and removed. The Bigelow operation was performed. The instruments were introduced four times. Time one hour and ten minutes. He was put in bed and stimulants given. A flaxseed poultice was applied over the bladder, and soon after one-sixth grain of morphine was given hypodermically. Urine passed easily and at longer intervals than before operation. It contained more or less blood until the 18th. He had some diarrhœa on the 19th, which was readily controlled. On the 21st, the bladder was washed out with a solution of borax one drachm to the pint of warm water. There was considerable pus in the urine. The temperature was not above 100°, and generally about normal. The bladder was sounded on the 29th and no calculus was found. He left the hospital three and a half weeks after the operation.

November 19th, taking iron and quinine internally. The bladder was washed out once a day. He slept well, could hold his urine from four to six hours without any effort; caused some irritation on passing. General health improved very much. Had gained eighteen pounds in weight; appetite good and his strength nearly returned.

About February 1, 1882, a small fragment was crushed by the Thompson method, without taking an anæsthetic. February 18th, sounded again, but found no stone. Cured.

This patient had such a fear of instruments, that he would not after

either operation allow the bladder to be properly washed out daily. Was made to drink freely of diluents.

I saw him occasionally for two years after the operation; he remained in excellent health, with no stone symptoms.

CASE XXIII.—Litholapaxy: recovery. Weight of detritus, 75 grains.

W. D., aged fifty-three, married, native of Ireland, laborer, Albany, N. Y. Admitted April 18, 1882. Patient gave a history of descent of renal calculus about sixteen years ago, and the subsequent passage through the urethra of a stone about the size of a plum pit. He had suffered all the signs of stone. April 20, 1882, he was etherized and Dr. Snow performed the Bigelow operation, which lasted one hour. He ralled nicely from the operation, suffered but little, and made a good recovery. Though the stone was small, much difficulty was experienced in grasping it, as it seemed to float about, and would occasionally hide, as it were, in some sac. When caught, it broke readily with a distinct sound.

This patient was entirely well two years after the operation.

CASE XXIV.—Candle-wick as nucleus; litholapaxy: recovery. Weight of detritus, 240 grains.

D. B., aged fifty-three, native of United States, boat captain. Admitted July 24, 1882. Discharged August 21st improved. About thirty years since had gonorrhœa, and eight or nine years after had a second attack; no stricture or other difficulty either time, so far as he knew. About two years ago, noticed soreness of urethra, also extending into the bladder, which was recognized as cystitis, necessitating cessation from labor, and since that time has been unable to work. This patient admitted that at the time the cystitis developed he had practised masturbation by introducing a portion of candle-wick into the bladder. It slipped from his fingers in the excitement and passed into the bladder. It is to be observed as the nucleus of the stone.

Family history: Father died aged seventy-five years. Mother died of phthisis, aged fifty years. One sister died aged forty, and another aged forty-three, of debility. Has one brother and two sisters living and in good health.

Symptoms of stone for two years. Condition good. Urine carefully examined; no evidence of disease of the kidneys. Stricture in spongy portion of urethra first cut; stricture in membranous portion divulsed,

and litholapaxy done July 27th. No untoward symptoms followed. Detritus phosphatic. Bladder washed, patient sounded twice. No evidence of stone. Made an excellent recovery.

CASE XXV.—Litholapaxy: recovery. Weight of detritus, 660 grains. Second operation done about a year later at Scranton, Pa., by Dr. Keyes, of New York.

J. W. R., aged thirty-six, married, native of the United States, clerk, Scranton, Pa. Admitted to the Albany Hospital August 22, 1882. No history of stone in the family, but one uncle had gravel. In December, 1871, had an attack of renal colic, lasting about six weeks. About one year later, had a second attack of three weeks duration. In 1873, first noticed pain at end of penis, also at times blood oozed from meatus after voiding urine; these, together with other symptoms of vesical calculus, had persisted until the present time. In 1875, had third attack of renal colic. During the tenth day of this attack he passed a gravel stone as large as a pea. Operation of rapid lithotrity was performed August 22, 1882, lasting about one hour. Patient had no chill or unfavorable indication of any kind. September 1st, he had diarrhœa; urine decomposed on passing. September 2d, diarrhœa continued, bladder washed. Patient complained of pain in head and chest. On the 5th his pulse was 80. Temperature rose to 104¼° in the morning, but fell to 99½° in the evening—no apparent cause; patient felt very comfortable. Urine looked better, specific gravity 1.008, no albumen,. crystals of phosphates, a small amount of blood and pus. On the 19th, passed two stones, each about the size of a pea. Evening: complained of pain in the end of penis. On the 13th, left the institution to stop with a friend in town, and returned to the hospital from time to time. Evening: Patient returned with hemorrhage from urethra or bladder. Had passed clots and bloody urine before. On the 14th, evening, patient still passing bloody urine per catheter. Urethra plugged with clots. Bladder was washed out daily with a solution of borax, one drachm to the pint of warm water. He gradually improved, and returned to his home feeling very well. I sounded him twice after the operation, and when he had ceased passing detritus, and failed to detect any portion of calculus.

February 10, 1883, I received a letter from Mr. R.'s physician, Dr. Newton, of Scranton, Pa., requesting me to come on there, stating that Mr. R. had another stone, and desired me to do a second operation. While making arrangements to leave some urgent cases, and having a

proper understanding as to terms, etc., Mr. R. became impatient, and sent to New York for Dr. Keyes, who responded at once, and went on and removed without any trouble, a small phosphatic stone, Feb. 17th. Patient made a rapid recovery.

CASE XXVI.—Litholapaxy: recovery. Weight of detritus, 420 grains. Death seven weeks after operation, from acute diarrhœa.

C. N. N., aged sixty-seven, married, three children, good habits. Seven years ago had typhoid fever. Some time after, noticed trouble in passing urine. Had had no renal colic. Was under treatment for cystitis. Two weeks ago was sounded, and a stone was found in the bladder. Came to the Albany Hospital October 19, 1882. Another sounding was done, and the diagnosis confirmed. Stone was large, firm, and solid. Condition of urine favorable; alkaline reaction; specific gravity, 1.008; no albumen; oxalate of lime crystals present; patient has to use the catheter to empty his bladder; had used it for two years.

Anæsthetized and a Thompson's sound introduced; a stricture found in spongy portion. Urethratome passed and stricture cut. When sound entered the bladder a distinct click was heard, exaggerated by means of the sounding board. Bigelow's lithotrite was used to crush the stone, which measured one and one-half inches. All washed out except one piece, which it seemed advisable to leave for another operation he becoming very weak; the operation lasted fifty minutes. Bladder was washed out occasionally with a solution of borax. Was put to bed, and means used to prevent a chill. October 28th, temperature 103° after the operation. The next morning temperature was 100°. Desired to urinate every two hours. Had passed urine voluntarily; catheter used three times. General condition good, February 27, 1883. Ten days after the operation, the remaining piece was crushed. Three weeks after the first operation he had an uncontrollable diarrhœa, and he gradually became weaker, and died seven weeks after the first operation. Bladder symptoms had all abated.

CASE XXVII.—Litholapaxy, two operations: recovery. Weight of detritus at first operation, 60 grains.

S. B., admitted to the Albany Hospital August 7, 1883, and a phosphatic calculus removed. No ether given. Patient discharged from hospital August 20th.

Patient returned October 2d. Operated on the 6th, removing more phosphatic material, patient being this time under ether. No

bad effects followed the use of ether, and no fever followed operation. Patient discharged from hospital on the 19th, cured.

CASE XXVIII.—Operated on by Dr. N. L. Snow; attempt at litholapaxy; breaking of lithotrite; lithotomy, lateral: death. Weight of stone, 450 grains.

W. G., single, aged twenty-five, engineer; residence, Roseboom, N. Y. Came from Ireland in his early youth. Ten years ago lived a short time in Jefferson, Pa. With this exception has lived in Otsego County, N. Y. Parents living and healthy. Has four brothers and two sisters living, all healthy, with the exception of one brother, who is said to have some difficulty with his kidneys. Patient has never been strong. Has complained for ten years of pain in passing water, and occasional stoppage; said to be worse after drinking coffee. No other drink seemed to affect it. Last February was confined in bed for two weeks. Was sounded, and a large-sized vesical calculus detected. Saw Dr. Snow about June 10th, who found a stone, and advised an operation. He was admitted to the Albany Hospital June 25, 1884. On the 28th he was placed under ether, and after injecting the bladder with warm water, the lithotrite was introduced, and the stone grasped. Its diameter appeared about two inches. Force was applied, and the stone broke. Attempts were then made to crush the parts, with but poor success. The instrument was then withdrawn, and an attempt made to wash out the particles. This not succeeding, the instrument was again introduced, and another portion of the stone grasped. The stone appeared very hard, and in attempting to crush it the instrument broke about half an inch from the end, leaving the portions of both blades in the bladder. The patient was then placed in position, and the lateral incision was made for lithotomy. The bladder was opened on a rectangular staff, and the forceps introduced. The stone was readily grasped, and after considerable manipulation was extracted. Portion of instrument and small particles were also removed. The stone was very rough and hard, and its surface was covered by connective tissue shreds. Weight, one and a half ounces. Bladder was then washed out with carbolized warm water. There was scarcely any hemorrhage during the operation, but he lost six or eight ounces of blood later in the day. Patient was rather slow in recovering from ether. Operation lasted about one and one-half hours. Milk and whiskey every two hours. In the evening his temperature was 100° F., pulse 140. June 29th, temperature 102°, pulse

140 night and morning. Was given one grain of opium every two hours. June 30th, rested fairly well during the night. Urine passed through wound. A. M.: temperature 103°; pulse 140. P. M.: temperature 102°; pulse 128. July 1st, treatment continued; had diarrhœa—four passages during night. P. M., opium pill stopped, and camphor and opium pill given for diarrhœa. Hot applications applied over abdomen, with a few drops of oil of turpentine rubbed on each time; temperature 101°; pulse 120. July 2d, no change in treatment; temperature, A. M., 102°, P. M. 104° axillary. July 3d, temperature $98\frac{4}{10}°$; pulse 140. About 4 A. M., vomited a little two or three times, afterward troubled with eructations, pulse growing weak. 12 M., pulse weaker and extremities cold. Vomited during afternoon. Was given milk and lime-water. Gradually grew weaker. and died about 8 P. M. No post-mortem.

Case XXIX.—Litholapaxy: recovery. Weight of detritus, 36 grains.

P. B., admitted into the Albany Hospital July 26, 1884. Had had symptoms of vesical calculus for nine years. Stone was crushed July 28th, without an anæsthetic. Patient walked to his room after operation and has had no unpleasant symptoms since. There was no rise in temperature, nor any constitutional symptoms. Patient discharged cured on the 31st. This patient was a remarkable example of non-sensitive urethra and neck of bladder.

Case XXX.—Litholapaxy: recovery. Weight of detritus, 700 grains. Second operation one year later: recovery. Weight of detritus, 420 grains.

W. J. DeG., aged fifty-four, married, merchant, of good habits. Had had symptoms of stone nearly four years. Entered Albany Hospital October 23, 1884. On sounding, stone was easily detected. I operated October 24th; time, fifty minutes. Patient recovered without unpleasant symptoms, and bore his daily washings of bladder without complaint. On careful sounding, bladder was found in good condition, no fragments detected. Discharged cured November 1st.

September 29, 1885, patient returned, having suffered for three months from his old symptoms of stone. On sounding a calculus was detected. He was in good condition. Some cystitis was present. A second operation was done on the 30th, with an excellent result.

Discharged in a week, feeling better than ever. Has remained well since.

CASE XXXI.—Litholapaxy tried; patient sank so rapidly that operation was abandoned: death. Weight of stone removed at autopsy, 1000 grains.

F. M. W., aged thirty-five. Patient had had for four years severe symptoms of stone in the bladder, and until last few months had been quite intemperate. Since then he had been sober, though nervously unfit for an operation, until December 29, 1884. Patient was with difficulty etherized. Litholapaxy tried. There was found a large stone present. Lithotomy was advised, but the patient sank so rapidly under the ether that it was thought best not to proceed. He did not rally well, and suppression of urine following, he died at the end of forty hours.

Autopsy revealed four pus cavities filling all portions of the kidneys, ureters filled with pus, bladder sacculated and dilated like little finger.

I was told after his death that he had been very intemperate and exposed himself sadly. Gave no history of renal colic, but the nucleus of the stone, as you will observe, is made up of uric acid. Outside secondary deposits, phosphates.

CASE XXXII.—Litholapaxy; second operation: recovery. Weight of detritus, 30 grains.

G. F., aged sixty-eight, married, retired farmer. Gave a history of calculus of about five years' duration. Was operated on ten months ago by Dr. Gouley, of New York, for good-sized stone, by rapid lithotrity. Made a good recovery, and was comfortable up to three or four months since, when his bladder trouble returned. Entered Albany Hospital June 16, 1885. I operated under ether June 20th, by litholapaxy, removing a small calculus after crushing once. Recovered nicely, bladder washed out, and he was made very comfortable by his physician, Dr. Keifer, until his death three months ago.

CASE XXXIII.—Litholapaxy: death from peritonitis on the fifth day. Weight of detritus, 50 grains.

J. G., aged fifty-six, November 6, 1885. Had passed renal calculi during the last three or four years. A week ago he came to the Albany Hospital, when he was sounded and a stone found present.

He had frequent desire to urinate, pain in head of penis and after passing water, and at times sudden stoppage of the stream.

Diagnosis was made of vesical calculus, probably multiple, caused by renal calculi retained in the bladder. Ether was administered by Dr. King. Thompson's searcher was introduced into the bladder, the stone found, and three or four ounces of a solution of borax injected. Keyes's lithotrite was then introduced, and the stone caught and crushed. A No. 27 washing-out catheter (Bigelow's) was introduced, and the bladder washed out with borax solution. Considerable detritus was washed out. The crushing and washing out were repeated, when the searcher failed to find any more pieces. The meatus was slightly contracted, and was enlarged by cutting with the meatotome. Patient was placed in bed with bottles of hot water, and given five grains of quinine, repeated every six hours; also given a rectal suppository of opium and belladonna at night, and ordered to drink freely of mucilaginous drink, and citrate of potash to relieve the acidity of the urine. Was watched closely for signs of urethral fever and suppression of urine. After twenty-four hours the bladder was washed out with borax solution. Benzoate of soda was given for the cystitis. November 7th, patient rallied well. Had had urine drawn every two hours, and had had no pain or chill. On the 11th, peritonitis set in, and patient died next morning.

At the autopsy the kidneys were found in a condition of beginning degeneration, and the pelves were filled with pus. The bladder contained a number of small pieces of calculi lying behind the enlarged prostate, and the walls were enormously thickened. The peritoneum was much congested, and in a condition of active inflammation.

CASE XXXIV.—Litholapaxy: recovery. Weight of detritus, 120 grains.

J. W. G., aged seventy-three, married, and a resident of Vermont, had enjoyed good health up to about ten years ago, when he began to have bladder trouble. Passed several calculi, but was not obliged to use a catheter until five years ago. He began to have at that time the usual symptoms of stone in the bladder, viz., bloody urine, pain at the end of penis, etc. He entered the Albany Hospital October 27, 1885. I examined him, and the diagnosis of vesical calculus of phosphatic formation was made. Was operated on October 30th, Bigelow's operation being done. A large quantity of stone was washed out. Rallied well from the ether, but on the third day his temperature in-

creased to 103°, pulse 120, and he complained of severe pain in the bladder, which was relieved by hypodermics of morphia and rectal suppositories. His urine was drawn, and bladder washed out daily with borated water. Ten days after the operation, he was again put under ether and examined, and a fragment of stone discovered. This was crushed and washed out. From that time he began to improve, and was discharged cured November 21st.

March 1, 1887, patient had gained thirty-five pounds in weight, and was in perfect health. No bladder symptoms.

Of all my stone cases, I consider this the most satisfactory in its results. When the patient came to hospital he begged not to be cut.

CASE XXXV.—Rapid dilatation of urethra: recovery. Weight of detritus, 157 grains.

Mrs. L. L. D. was admitted into the Albany Hospital December 15, 1885. She had been feeling ill for the last four years. First noticed severe pain over kidneys, for the relief of which blisters were applied. Pain soon returned. About eleven months ago experienced severe pain over bladder. Began to pass urine much more frequently than before, causing pain of a cutting, burning character. Urine was dark in color, with a deposit, white at first, but red or dark on standing. For the last four months had been confined to bed. Had lost strength and flesh. December 16th, operated upon, and stone removed from bladder by rapid dilatation of urethra and aid of forceps, stone breaking easily. Patient had a chill December 17th, A.M., lasting about ten minutes. At 4 P.M. vomiting commenced and lasted until 10 P.M. Temperature 101.6°. Diarrhœa through the night. Slightly delirious. December 18th, A.M., felt much better; temperature 98°; bladder washed out, small quantity of mucus passed. Patient discharged from hospital cured, December 28th.

CASE XXXVI.—Soft phosphatic urethral deposit; retention of urine; deposit removed by milking penis.

B., aged fourteen months; poorly fed and hygienic surroundings bad. Was seen October 8, 1875, by Dr. N. L. Snow, after having suffered for nearly two days with a frequent desire to urinate. On attempting to pass a catheter, a calculus was discovered lodged in the urethra, which was readily removed by milking the penis. The deposit was simple phosphates. The child recovered under the use of tonics, although the urine for a long time contained free phosphates.

CASE XXXVII. — Urethral calculus, lodged twenty-four hours; removed by milking urethra, by forceps, and incision of meatus.

F. G., aged six years. Seen by Dr. J. M. Bigelow, March 8, 1879, having had retention of urine for nearly twenty-four hours, and in much distress and suffering greatly from a constant desire to urinate. On examination with Dr. Bigelow, we found a calculus lodged in the prostatic portion of the urethra. Patient was given ether, and by a gentle milking of penis, together with Thompson's small urethral forceps, and by incision of the meatus, a calculus weighing nearly 15 grains was removed. The urine followed freely, the hypogastric tumor disappeared, and patient made a rapid recovery.

Stone was composed mostly of oxalate of lime.

CASE XXXVIII.—Litholapaxy: recovery. Weight of detritus about 120 grains.

J. B. C., aged forty-four, married, farmer, residing in Delaware Co., N. Y., admitted into the Albany Hospital March 30, 1885, with a history from his physician, Dr. Cartwright, of vesical calculus of between two and three years duration. Condition good. Examination of urine revealed no disease of the kidneys. April 4th, under ether rapid lithotrity was performed, patient making a rapid and complete recovery. Bladder was washed out daily with a solution of borax. Sounded carefully, no stone. Discharged April 22d, cured.

I examined this patient April 7, 1887. Bladder in fine condition. No evidence of stone. In every respect improved.

CASE XXXIX.—Litholapaxy; probably sacculated bladder: recovery. Weight of detritus, 420 grains. Second operation ten months after: death from peritonitis and suppression of urine. Weight of detritus about 30 grains.

John B., aged sixty-six, farmer, native of N. Y. State, widower. Had worked very hard all his life and been much exposed. Was admitted to Albany Hospital January 11, 1886. Had suffered from symptoms of stone nearly four years. Had been under the care of many irregular practitioners, and his case greatly aggravated. When sent to me by his family physician, Dr. Smith Baker, of Utica, he was discouraged, feeble, and emaciated. Urine revealed no disease of the kidneys. Sound detected readily a large stone. After washing out his

bladder daily, and the giving of quinine, and free movements from the bowels, on January 15th, he was given ether, and rapid lithotrity performed. Time, forty-seven minutes.

He made a most excellent recovery, the urine cleared rapidly, and he enjoyed the washing out of his bladder, but was obliged to use a catheter as he had done before the operation.

On January 25th, he returned home, bearing the journey well. From this time on he continued to improve, gaining in weight and feeling better than he had in years.

During August, 1886, while working harder than usual, he noticed his old symptoms returning. On September 10th, he was carefully sounded by the aid of cocaine, by Dr. Smith, and a small stone detected. October 2d, he again entered the hospital suffering much pain in the region of the bladder and extending up the ureters. His urine contained albumen and much pus, but no casts were discovered at any time. Under the use of cocaine I sounded him three times, and once detected a stone without a doubt. The next day he was given ether, and an attempt made to do litholapaxy, but no stone could be found. He continued to suffer, and on November 6th, under ether, with the understanding that I was either to repeat the old operation or cut, I passed a Thompson's searcher, detected calculus, and did a rapid lithotrity, washing out about 40 grains of detritus. He reacted well and the next morning was bright and cheerful, but at the end of thirty-six hours he began to show great depression both in body and mind, suppression of urine followed, and he died November 9th.

Report of autopsy made November 10th. Examination showed signs of recent peritonitis; the omentum and intestines were closely adherent; section through walls of bladder showed them to be greatly hypertrophied; some fluid and several small particles of calculi were found; also the remains of the cyst that held the stone; prostate enlarged; both kidneys diseased, right small and contracted, ureter enlarged; left somewhat contracted, ureter normal; sandy particles found in pelvis of both kidneys.

This was an undoubted case of sacculated bladder, and accounted for the last stone eluding us while searching for it.

This patient would probably have done better had we cut him suprapubic.

CASE XL.—Litholapaxy: recovery. Weight of detritus, 80 grains, largely uric acid.

A. B., aged forty-four, English by birth, and a good liver in every respect. Had had rheumatism. About two years ago began to show symptoms of stone. March 1, 1883, I assisted the late Dr. N. L. Snow in doing a litholapaxy. Patient took ether nicely and behaved well in every respect, making a rapid recovery, followed by no unpleasant symptoms.

CASE XLI.—Attempted litholapaxy; small portion of stone washed out, then could not be grasped by lithotrite, and further operative procedure postponed. Later lithotomy done by Dr. LeRoy McLean, of Troy, N. Y.: recovery. Weight of two stones, about 500 grs. Death two years afterward from some obscure disease of the kidneys, as reported to me by a friend of the family.

M., aged fifty-four, farmer, married, living near Sand Lake, N. Y. Had symptoms of stone at times for a period of nearly four years. About October 1, 1883, I attempted rapid lithotrity, but after grasping twice what seemed to be the edge of the stone, I failed to find it with searcher or lithotrite. Washed out about 30 grains of phosphatic detritus. He was more comfortable for a time, but his old symptoms returning, Dr. McLean, of Troy, was called and did a perineal lithotomy, with a good result. It was a case of sacculated bladder, and explained my want of success in the first operation.

The question has been asked in the past, and the attempt made to answer it, What is the best operation for stone? To-day, I fancy, the answer would be very different from that of but a few years since. If we examine critically the cases I have presented, we find that the mortality has been somewhat great. We also find that the conditions and time of life of the fatal cases have been very grave. Cases I., XVI., XIX., and XXXI., would, perhaps, have done better under the high or suprapubic operation; Cases I. and XIX., eminently so, although Case XIX. seems to have died more from shock, and may have had diseased kidneys. Case I. was a kind of stone very difficult to deal with. It was impossible to crush it by any known form of instrument, and Dolbeau's perineal lithotrite would have availed little. Case XXXI. would have died under any form of treatment.

His case was hopeless long before he presented for treatment, owing to his dissipated habits, and the serious condition of his kidneys.

Suprapubic lithotomy, under the stimulus given by late improvements in the manner of reaching the bladder, and which have been so ably presented to us to-day, is likely, for a time at least, to receive much attention from surgeons who, in operating, think they have a large stone to deal with.

Large stones carry with them a record of much suffering and damage to the system. Fortunately, as the public become better informed, these cases are likely to grow less. They present too often the true surgical kidney, and which to me has been difficult of diagnosis in many cases. Case XXXI. could not have been saved by any method of treatment, and I am only thankful that he did not die on the table. Had I known more about tumors of the bladder, I am convinced that Case XVI. would have been a proper one for exploration, either by the perineal or suprapubic method.

Of the clean lithotomies, the record of recoveries is as we might expect in such cases of moderate sized stones. They generally do well, and yet I am convinced that this operation for the present, if not for all time to come, must go to the wall. In the minds of patients and their friends, the cutting operation is obnoxious; they shrink from its performance, and often readily yield to the crushing operation in whatever form it may be presented. When we consider the possibility, though rare, there is of sterility resulting in any of the perineal operations, and the great dislike to the use of the knife, and the very recent advances and successes in litholapaxy in the young male, we are forced to conclude that soon perineal lithotomy in any form will be an operation seldom done. Some form of severe cystitis or malformation may call for it, but not the medium or small stone.

In the study of the suprapubic operation, one is impressed with the earnestness with which it has been presented by some American writers in the past, and the eagerness with which the operation is now being performed abroad, especially by Sir Henry Thompson and others in England.

By the aid of a former student, Dr. W. G. McDonald, now of the Albany Hospital, I am able to present a few statistics on this subject which I think of value here. With the excellent results we are ever likely to obtain from rapid lithotrity, the operation must necessarily deal with severe cases of large, and in some instances sacculated, stone. I do not believe that we should ever expect from it as great a per cent. of recoveries; it is hardly possible.

No.	Operator.	Age.	Character of calculus.	Weight of calculus.	Died.	Recovered.	Period of convalescence.	Where reported.	Complications, Indications, Accidents.
1	T. Smith,	43	Phosphates.	24½ ʒ	...	1	Protracted.	Lond. Lancet, 1886.	Large stone; a second operation was necessary to close fistula.
2	W. H. A. Jacobson,	19	Oxalates.	Not given.	...	1	3 weeks.	British Med. Journ., Oct. 23, 1886.	Multiple calculi; long duration of symptoms; probable disease of kidneys.
3	Do.	40	Lithic acid.	Not given.	...	1	4 weeks.	"	Irritable bladder; cystitis, hemorrhoids, spinal curvature; hard and uneven stone.
4	Do.	48	" "	6 ʒ	...	1	9 days.	"	Free hæmaturia; enlarged prostate; small urethra; old pelvic disease.
5	Do.	5	Mixed.	Not given.	...	1	3 weeks.	"	Cystitis.
6	M. F. Guion,	42	"	827 grs.	...	1	4 weeks.	Bost. Med. and Surg. Journ., Nov. 11, 1886.	Two calculi; perineal fistula; partial ankylosis of lower extremities.
7	A. T. Cabot,	49	.....	1180 grs.	...	1	3 weeks.	"	Large stone; stricture.
8	Walter Pye,	48	Phosphates.	3 ℥	...	1	5 weeks.	British Med. Journ., 1886.	Large stone; stricture; perineal fistula.
9	T. Annandale,	4½	Uric acid.	Small.	...	1	Speedy.	"	Tube and catheter removed in 48 hours.
10	Sir H. Thompson,	36	Cystine.	2¾ ℥	...	1	.....	Lond. Lancet, 1886.	No indications given other than large stone.
11	Do.	12	Uric acid; oxalates.	1½ ℥	...	1	.....	"	" " " "
12	Do.	62	Uric acid.	14 ℥	...	1	.....	"	" " " "
13	Do.	73	" "	2 ʒ	...	1	.....	"	" " " "
14	Do.	70	" "	Large.	1	..	.....	"	" " " "

15	Sir H. Thompson,	76	Uric acid.	6½ ℥	...	1	.....	Lond. Lancet, 1886.	No indications given other than large stone.
16	Do.	66	Phosphates.	.....	...	1	.....	«	Phosphatic deposit relieved by permanent drainage.
17	Do.	63	Oxalate of lime.	1½ ℥	...	1	Speedy.	«	Indication same as No. 10, etc.
18	Do.	50	Uric acid.	2¼ ℥	...	1	«	«	« « «
19	A. J. Gerster,	50	Not stated.	Large.	...	1	.....	Med. Reg., 1886.	Patient emaciated; rigors before operation; four large stones.
20	Richard Barwell,	9	Not given.	2¼ ℥	...	1	Speedy.	British Med. Journ., 1886.	Large stone in a child aged nine.
21	Do.	60	«	.....	...	1	Slow.	«	Large stone; peritoneum seen.
22	W. Rivington,	61	Lithic acid.	23 ℥	...	1	.....	«	Stone was 4⅜, 3¼, and 3 inches in various diameters. Died three months later of cystitis.
23	J. H. Morrison,	52	Uric acid.	1 lb. 6½ ℥	1	..	.....	«	Multiple calculus; operation after perineal failure. Death tenth day, uræmia.
24	L. McPhaid,	11	Not given.	7 ℥	...	1	Speedy.	Med. Reg., 1886.	Large stone in child.
25	J. N Howe,	16	«	3541 grs.	...	1	4 weeks.	Report Trans. Copenhagen Congress.	All other methods first tried; peritoneum opened.
26	Lichtenberg,	15	«	7 ℥	...	1	Slow.	Lond. Lancet, 1886.	Cystitis; emaciation and fistula followed.
27	A. W. M. Robson,	38	Lithates and phosphates.	Large.	...	1	2 weeks.	British Med. Journ., 1886.	Encysted stone; severe cystitis.
28	Do.	4	Uric acid.	40 grs.	...	1	13 days.	«	No indication given.
29	W. S. Tremaine,	3½	«	9 ℥	...	1	Rapid.	Med News, 1884.	Large calculus; peritoneum seen.
30	Pilcher,	21	Oxalates and uric acid.	207 grs.	...	1	11 days.	N. Y. Med. Journ., 1886.	Case reported at meeting of New York Surgical Society, and the method of procedure discussed adversely by Sands and others.
31	Sir W. MacCormac,	7½	Uric acid.	.....	...	1	2 weeks.	Lond. Lancet.	No special indication.

SUPRAPUBIC LITHOTOMY—*continued.*

No.	Operator.	Age	Character of calculus.	Weight of calculus.	Died.	Recovered.	Period of convalescence.	Where reported.	Complications, Indications, Accidents.
32	Lawson Tait,	...	Not given.	.....	...	1	.....	Med. Press and Circular, London, 1884.	A woman.
33	Td. O. Hyatt,	...	"	.....	...	1	.....	North Carolina Med. Journ., 1883.	No history obtained.
34	Do.	...	"	.....	...	1	.....	"	" "
35	Humphrey,	3½	.....	Large.	...	1	.....	Proceedings West London Society, 1884.	" "
36	A. Graws,	...	Not given.	.....	...	1	.....	Canada Journ., Med. Science, Nov. 1881.	" "
37	Do.	...	"	.....	...	1	.....	"	" "
38	W. T. Belfield,	70	"	2℥ 6ʒ	1	..	.....	Med. Reg., 1886.	Multiple calculi; severe cystitis; contracted bladder; enlarged prostate. Death from bichloride of mercury poisoning(?).
39	Guyon,	72	Hard.	3 ʒ Large.	...	1	5 weeks.	Amer. Journ. Med. Sci., April, 1883, p. 591.	Nine days earlier an attempt to crush had failed.
40	Do.	69	"	2 ʒ	1	..	.....	"	Death on third day from subperitoneal infiltration of urine.
41	Do.	69	"	Multiple, 4 ʒ	...	1	6 weeks.	"	Two calculi weighing two ounces each. Eleven days before an attempt to crush had failed.
42	Do.	57	"	2 ʒ+	1	..	.....	"	Died on twelfth day; lithotrity had failed ten days before.

43	Guyon,	60	.....	Very large.	...	1	7 weeks.	Amer. Journ. Med. Sci., April, 1883, p. 591.	Encysted stone, so located that no instrument could pass; stone broken before removal.					
44	Geo. W. Rachel,	4	Uric acid.	44 grs.	...	1	3 weeks.	Ibid., 1879.	Long continued symptoms, debility, etc.					
45	Mercier,	30	Not given.	3½ ʒ	...	1	6 weeks.	Ibid., April, 1878.	Case reported by Dr. C. W. Dulles in Amer. Journ. Med. Sci., 1878.					
46	Bell,	4½	.....	16 grs.	...	1	2 weeks.	"	"	"	"	"	"	
47	Do.	3	.....	96 grs.	...	1	3 weeks.	"	"	"	"	"	"	
48	Do.	2	.....	120 grs.	...	1	4 weeks.	"	"	"	"	"	"	
49	Do.	3½	Not given.	Large bean size.	...	1	9 weeks.	.....	"	"	"	"	"	
50	Brodie,	35	"	Walnut size.	...	1	.....	.....	"	"	"	"	"	
51	Brady,	42	"	2½ ʒ	...	1	3 weeks.	.....	"	"	"	"	"	
52	Betz,	6	"	Acorn size.	...	1	6 weeks.	.....	"	"	"	"	"	
53	Do.	8	"	Cherry size.	...	1	6 weeks.	.....	"	"	"	"	"	
54	Deering,	46	"	9½ ʒ	...	1	2 weeks	.....	"	"	"	"	"	
55	Watson,	56	"	8½ ʒ	...	1	6 weeks.	.....	"	"	"	"	"	
56	Boch,	6	"	1 ʒ	...	1	3 weeks.	.....	"	"	"	"	"	
57	Do.	3	"	35 grs.	...	1	2 weeks.	.....	"	"	"	"	"	
58	Do.	4½	"	59 grs.	...	1	2 weeks	.....	"	"	"	"	"	
59	Bailey,	2⅔	.....	54 grs.	...	1	3 weeks.	.....	"	"	"	"	"	
60	Langenbeck,	1¾	.....	Date-seed size	...	1	2 weeks	.....	"	"	"	"	"	
61	Starr,	35	.....	9 ʒ	...	1	5 weeks.	.....	"	"	"	"	"	
62	Fletcher,	2½	.....	69 grs.	1	..	.....	.....	"	"	"	"	"	Died on second day.
63	Rachel,	4	.....	2 ʒ	1	..	.....	Amer. Journ. Med. Science, April, 1878.	General condition very poor; kidney complications. Death on 7th day.					
64	Amussat,	4	Urate of ammonium.	720 grs.	...	1	Protracted.	Ibid., Jan. 1877.	No stone could be detected before operation.					

It will be observed that there are several cases of quite small stones among the number reported that could have been operated on by rapid lithotomy; but then, again, this operation was not known when some of these cases were done.

SUMMARY OF TABLE.

	Recoveries.	Deaths.	Total.
Cases, all ages	56	8	64
under fifteen years	23	2	25
between 15 and 50 years	17	1	18
over 50 years	11	5	16
ages not given	5	0	5

Sir Wm. MacCormac, F.R.C.S., gives the following statistics, in an artice published in the *British Medical Journal* of March 19, 1887:

		Mortality.
Recent foreign cases, adults	46	19.6 per cent.
British " "	57	31 "
Cases from table "	39	15.3 "
Recent foreign cases, children	55	23.6 "
British " "	33	0 "
Cases from table "	25	8 "
Whole number of cases, adults	142	22 "
" " " children, under 15 years	113	10.5 "

It will be remembered that, at the fifty-fourth meeting of the British Medical Association, in 1886, Sir Henry Thompson said in substance of the suprapubic operation:

"I shall venture to maintain that it is decidedly superior to the lateral for the removal of stones which are much above the average size, and I do so upon the following grounds:

"First. Because in the suprapubic operation there are no structures lying in the line of incision, or sufficiently near to be liable to injury by the knife or forceps.

"Second. Increased space for the removal of stone.

"Third. Little or no danger from hemorrhage.

"Fourth. Ease of operative procedure.

"Fifth. Because, in the after-treatment, the urine leaves the bladder more directly than by the lateral method.

"Sixth. Because in the suprapubic, antiseptic dressings may be employed; the contrary in the lateral operation.

"Seventh. In the suprapubic, it is impossible to cut the rectum, or inflict injury to the sexual organs, or to make recto-urethral or perineal fistula, all of which accidents are liable to follow lateral operations."

The objections to the suprapubic operation, as presented and discussed by Sir Henry Thompson, are:

"First. Opening the perineum.

"Second. Extravasation of urine into the cellular tissue about bladder.

"The later objection is the least considerable. Should any one object that urine may be extravasated about the base of the bladder and corrupt the parts, I answer that it only happens when the parts have been improperly separated by the operator.

"In regard to the first objection, it does not occur in the practice of the modern method."

In my readings and report of cases, I find that the peritoneum has been seen rarely, and opened but once in any operation.

Sir Henry Thompson went on to say:

"I shall never fail to regret that it was not in my power to apply it earlier in my career, in removing some of the larger stones before you."

In the discussion which followed, Mr. Reginald Harrison expressed himself as favorable to lateral lithotomy in children, having operated fifty times without a death. In adults, he preferred lithotrity, save in rare cases. He had experienced no difficulty in removing stones up to five ounces by the perineal route. He would be very reluctant to abandon the lateral for suprapubic, save for very large stone.

Mr. Cadge would not go as far as Sir Henry Thompson, with whom he agreed in a measure. He thought a middle course the safest.

Mr. Jessup spoke of the difficulty of removing large stones by the lateral operation in children, and enlarged prostate, etc.

Mr. Barwell agreed with Sir Henry Thompson, and spoke of vesico-vaginal fistula in little girls.

Dr. Ward Cousins spoke of the advantage of the suprapubic operation in encysted stone, and great prostatic hypertrophy.

Sir William MacCormac expressed his belief that in children the greatest future development of the suprapubic operation would occur.

Mr. Jacobson called attention to the recurrence of stone after lithotrity; quoting Mr. Cadge, he said it recurred in twenty per cent. of cases; in lithotomy, recurrence took place in only two per cent. He favored wide application of the suprapubic operation.

The operation was discussed by others favorably.

In the *British Medical Journal* of February 13, 1886, Mr. Reginald Harrison advocated perineal lithotomy in cases having enlarged prostates, claiming reduction of hypertrophy by operation, as against suprapubic lithotomy.

Prof. Dittel says that the future of stone lies between litholapaxy and suprapubic lithotomy.

At the Fifteenth Congress of the German Surgical Society, in 1886, Prof. König submitted the following thesis for discussion:

"That perineal lithotomy (median) section is, as a preliminary operation for getting rid of small stone, almost free from danger. It is also quite sufficient for removal of medium-sized stones and common movable foreign bodies.

"If there be very large or numerous calculi, encysted calculi, or foreign bodies of a peculiar kind, especially metallic bodies, the entrance in the bladder obtained by this operation is insufficient.

The high operation is preferable in difficult cases."

Dr. Koser, of Marburg, advocated high operation, as did Drs. Bergmann and Trendelenburg. Others favored lithotrity.

At the meeting of the American Surgical Association, in 1884, Drs. Gouley and Gunn opposed the suprapubic operation, while Drs. John B. Roberts and W. S. Tremaine spoke in terms of highest praise. Dr. Dawson further stated that many calculi seen in the Western States were so hard as to render crushing very difficult.

I think we have yet a great advantage to derive from the

suprapubic operation in encysted stone, and when a sacculated bladder is present; also in hypertrophy and inflammation of the prostate, and in some forms of cystitis.

The production of sterility in the male by perineal lithotomy, Teevan's four childless husbands, and Sir William MacCormac's remarks on the same, should claim our earnest attention.

It is by no means certain that a suprapubic fistula may be better for the patient than one situated in the perineum.

I select a note from a lecture by Mr. William Cadge, F.R.C.S., in June, 1886. He says:

"We have in children lack of room in lateral lithotomy, and difficulty in introducing finger into the bladder, as has been my experience, as well as that of the late Sir William Fergusson and Keith."

Mr. Cadge goes on to say that, among the great dangers of perineal lithotomy, are wounding of the rectum, hemorrhage, and leaving stone in bladder after operation.

In concluding his course of lectures, Mr. Cadge submitted the following summary of conclusions:

"1. In children, litholapaxy should be more generally adopted than hitherto.

"2. In male children, when stone is at all large, the suprapubic will probably be easier and safer than perineal lithotomy.

"3. In female children, litholapaxy should be the rule for small, and the high operation for large, stones.

"4. In adult females, litholapaxy or dilatation and extraction, should be adopted for stones of moderate size, vaginal lithotomy for those somewhat larger, and the high operation for those of decidedly larger size.

"5. In adult males, litholapaxy should be the rule up to an ounce or an ounce and a half; or, for one of that size, lateral or suprapubic lithotomy should be more often adopted until its success or failure is demonstrated."

He states that the various symptoms following lithotomy are cardiac disturbances, syncope, angina, hiccough, and a grave symptom—polyuria.

The causes of death are often surgical kidney, pyæmia, con-

tracted kidney, infiltration of urine, pelvic abscess, peritonitis, exhaustion due to shock, and hemorrhage.

"Lastly," he says, "I have noticed in these fatal cases great enlargement of spleen. This occurred in very florid, elderly men, with blue feet and universal congestion. This condition and class of patients would now lead me to prefer litholapaxy in all practicable cases; and when not practicable, to adopt the suprapubic operation. Again, recurrence of stone after lithotomy is a matter of much interest, because of its bearing upon choice of operation; on the one hand between suprapubic and perineal lithotomy, and on the other hand between lithotomy and lithotrity. If it can be proved that the recurrence is far more frequent after lithotrity than after cutting operations, this fact should decide one to adopt lithotomy."

It will be observed that in the cases I have reported, the litholapaxies where the stone was small, and even up to moderate size, did quite as well as the clean lithotomies. At the present time, if I were to present conclusions from my own experience and reading on the subject of vesical calculi, I should say that the cases suitable for suprapubic operation, and reasons for the performance of the same, are those so earnestly stated by the authors whom I have quoted in this paper.

Regarding the operation of rapid lithotrity, there is much that is wanting in the study of the after-condition of the patients, and we ought soon to have valuable statistics upon the subject. I should like very much to know the real percentage of second and third operations in these cases. In lithotomy and the old method, lithotrity, Thompson's cases, numbering 716, present the following:

Number operated upon second time . . .	61
Number operated upon third time . . .	9
Number operated upon fourth time . . .	3
Number operated upon fifth time . . .	2

Also, quoting C. Williams, who says that in 935 lithotomies collated, recurrence took place in 1 case in 33.

In a note from the records of the Norwich and Norwalk hospitals, compiled by Mr. Donald D. Day, he says:

"In a series of 1125 cases, there were 51 females without recurrence, leaving 1074 males. To first operation, 140 succumbed, and 50 were

for recurrent stone, leaving 884 individuals in which stone might recur. It recurred in 45, an average of 5.09 per cent., and in 5 it recurred a second time. Of the cases of recurrence, 12 were in children, and 23 of the rest were above 50 years."

The causes of recurrence were—

1st. Descent of fresh stone from kidneys.

2d. Stones undetected at first operation.

3d. Stones formed on a fragment left behind.

4th. Due to chronic cystitis.

In 50 cases 20 were due to the first cause; 9 to the second; 5 to the third; and 16 to the fourth.

These figures refer to recurrence after lithotomy (perineal).

I desire to remark that in this observation we must consider the fallacy of all statistics of the operation, as many cases never return or go elsewhere.

The operation of litholapaxy is certainly indicated where the stone is small or of moderate size, and, contrary to the teachings of a few years since, can be done in very young male children with proper instruments In male adults, if there is severe chronic cystitis, I care not as to the size of the stone, the suprapubic or some form of perineal lithotomy seems best. The cystitis can then be treated successfully, and there is less danger of a reformation. I believe that future statistics will show that cystitis has much to do with the necessity for a second and third operation in litholapaxy. I believe there is one condition in adult males that has not yet received the attention it is bound to demand, and that is, the contracted bladder with adhesions, and that must in some instances embarrass the doing of the suprapubic operation. On anatomical grounds, the suprapubic operation will even be much simpler in the youth, as it is well known that the bladder is much higher in the pelvis at this time in life.

In girls rapid lithotrity or suprapubic lithotomy will undoubtedly reach all cases. In adult women vaginal lithotomy may be added. Like all surgical conditions, it is a solemn position for a surgeon to have his patient, with stone, tell him, "My case is in your hands. I desire you to perform whatever operation seems best in this particular instance."

Can we yet classify our cases with certainty as to what is the best and most certain course to pursue for the safety of our patient's life and future comfort?

As a summary of my own cases, it will be noted there were 7 perineal lithotomies, with 2 deaths and 5 recoveries, the former being in old men and with very large stones.

Of attempted litholapaxies and an immediate perineal lithotomy, there were 2 cases, both resulting in death, one in my own practice and one in that of the late Dr. Snow. Both were very severe cases of large stone, and the patients presented a history of much suffering through many years.

Of dilatation in the female and washing out of fragments or removal of stone entire there were 6 cases, all recovering with no complication whatever.

Of urethral calculi in the male, there were 4 cases, all recovering.

Of simple lithotrity in the male, there was 1 case, followed by recovery.

Of attempted litholapaxies, but which were not completed, there were 4; 3 ending in death, and 1, the stone hiding in a sac, later underwent perineal lithotomy and recovered. One was probably complicated with some form of tumor of the bladder and had a history of chronic disease of the kidneys. One was a case of chronic alcoholism. One was complicated with sacculated bladder; and the last two were both cases of surgical kidney of the gravest kind.

Of the litholapaxies in the male, there were 18 patients, having 22 operations—4 requiring a second operation. Of this number, 16 recovered and 2 died. Of the latter, 1 after the first and 1 after the second operation.

In connection with this subject, I desire to speak of the great difficulty I have experienced in securing such an examination of the urine as would tell just the true condition of the kidneys. Casts are very generally absent; albumen can often be traced to the presence of pus; and I am convinced that we have yet much to learn from the surgical kidney.

DISCUSSION.

DR. WILLIAM T. BRIGGS, of Nashville, Tenn.

The time allotted for the reading of important papers which are yet to be presented is so short that the discussion must of necessity be limited. The subject matter of the very interesting papers to which we have been listening is, however, too important to be passed without notice, more especially as, in my opinion, the views advocated were too narrow and too exclusive. The essay of Dr. Dennis was very learned and classical, and he gave a very correct history as well as a most accurate description of the *technique* of the suprapubic operation for stone in the bladder, to which no one could find fault. But when he makes the sweeping enunciation that the suprapubic operation is the best, the easiest, and the safest of the cutting operations, and that it should and would hereafter be resorted to in all cases, under all conditions, and under all circumstances, except in those in which litholapaxy could be resorted to, and claimed further that the high operation and litholapaxy are best adapted to the removal of all kinds of calculi, I must take issue with him. It is my opinion that no one procedure for extracting stone from the bladder is applicable to all cases that may come under the surgeon's observation, but that each case as it presents itself should be closely scrutinized, and the operation suitable to that particular case be selected. I feel sure that the surgeon will best succeed who has a thorough knowledge of all the methods of operating, and selects the one best adapted to the case under consideration.

The world owes a debt of gratitude to Dr. Bigelow for the introduction of his method of rapid crushing and removal of stone. In suitable cases it is without doubt the best operation, and most patients prefer it because it is almost bloodless. To be eminently successful, however, in my judgment, it is essential that there should be a capacious and unirritable urethra and bladder, and a comparatively soft stone, conditions which are not often met with, at least in my practice.

The suprapubic operation has its place, and should be selected under certain circumstances; and there can be no doubt that it is the best in selected cases; for example, when the calculus is too large to be brought out through the perineum without bruising and tearing the soft parts and is too hard to be crushed through the perineum, or

when there is a deformity of the pelvic outlet, or some injury or deformity of the limbs which prevents them from being brought into the proper lithotomy position, or when there is a large and hard stone in a young female. In my judgment, the dangers environing this method of operation are greater than those attending the perineal methods. There are certainly greater risks of peritonitis and of urinary infiltration. Patients have died from distention of the bladder, and from the distention of the rectum necessary to push the bladder upward and forward, by rupture of those organs in the preparatory steps of the operation. There is some risk, too, of hemorrhage, though this is remote.

I cannot think that the operation is as innocent as the author of the paper would have us believe. It can, without doubt, be easily done, but whether the best and safest part of the bladder is reached and entered, is quite problematical.

The lateral operation, modified and improved by Cheselden in the seventeenth century, and changed but little since, is the operation now generally used when a stone is removed by cutting. The majority of surgeons employ it, and it certainly has advantages over the high operation, in that it can be done much more rapidly, with greater safety, and offers the most direct and best route for drainage.

The bilateral method, by offering a larger opening, may be selected when a very large stone is to be removed. By either of these methods, however, many important parts, muscles, arteries, veins, nerves, lymphatics, etc., are divided, which had best be avoided.

The median operation avoids the division of these parts by following the raphé, and is incomparable for the removal of small stones—but those of larger dimension cannot be extracted without the infliction of too much injury to the soft parts; nor can the instruments for fragmentation be easily and safely used. If, however, after a longitudinal section in the raphé passing through the perineal point, a slight bilateral incision of the elastic ring at the neck of the bladder and the prostate gland be made, the dilatability of the perineal structures is almost incredible, and almost any stone which can pass out of the pelvic outlet may be safely extracted. Nature seems to have purposed the median line, or raphé, for perineal lithotomy. For it is merely a fibrous seam, formed by the tendinous union of the perineal muscles serving to separate important parts of one side from the other, and permitting the surgeon's knife to reach and enter the bladder without

wounding any part of importance. It will be borne in mind that the superficial parts of the perineum, with the exception of the raphé itself, are made up of highly dilatable tissues, the tension of which is kept up by the raphé. If this is incised longitudinally the dilatability of the soft parts is very great. The relative dilatability of these parts is well illustrated by taking a sheet of India-rubber, through which passes a moulded seam, itself inelastic, and exerting contraction upon the whole. Cut this longitudinally, and the dilatability of the opening will be as much greater than that made by a transverse section as the circumference of a circle is greater than its diameter.

Now, when after a longitudinal incision has been made in the raphé, a slight cross-section of the deeper seated parts is accomplished, a dilatability of the perineal structures can be effected, which will give a sufficiently capacious entrance to the bladder for all practical purposes. This constitutes the medio-bilateral method of lithotomy, which was first introduced to the notice of the profession by Civiale, in 1828, and practised by him whenever he had occasion to resort to the cutting operation. The advantages of this method of lithotomy over the suprapubic, or any other method of cutting for stone, may be summed up in a few words:

1. It opens up the shortest and most direct route to the bladder.
2. It divides parts of the least importance.
3. It is an almost bloodless operation.
4. It affords a passage for the removal of any calculus which can be safely extracted through the perineum.
5. It affords the best passage for the fragmentation of unusually large calculi.
6. It reduces the death-rate to the minimum.

The most frequent objection urged to the median operations is their unfitness for the removal of large stones. I exhibit a few large stones that were removed by the medio-bilateral operation, the largest measuring two and a half inches in the longest and two and a quarter in its shortest diameter. If the soft parts were bruised or torn in their extraction it did not make any difference, for the patients from whom they were extracted made rapid recoveries. While such large stones have been successfully brought through the perineum, I, by no means, advocate the practice. When they are so large that their extraction requires a sufficient amount of violence to bruise or lacerate the perineal tissues, it is much safer to resort to perineal lithotrity; or, if the stone is too

hard to be crushed rapidly, to make a suprapubic section after the perineal operation, the safety of which is enhanced by the thorough drainage permitted by the lower opening.

The medio-bilateral operation is done with more ease than the lateral. It requires no additional instruments; I have sometimes used the lithotome caché, but have more frequently used an instrument made for me by Stohlman, for making the deep cross-incision, and with great satisfaction.

I had performed forty-five operations for stone before I adopted the medio bilateral method. Three or four were done by the lateral method, and the rest by the bilateral with the lithotome caché, under the teaching of the late Prof. Paul F. Eve, who was its great champion in this country. Upon one occasion I visited a young man in the eastern part of our State, and removed a large stone by the bilateral operation. The operation was followed by a profuse hemorrhage, which was promptly arrested with the chemisetted catheter. Through some misunderstanding with the medical gentleman left in charge of the case, the tampon was removed too early, the hemorrhage returned, a solution of Monsel's salts, in which the attendant had great confidence, was applied, bleeding recurred; iron was again applied, and so on, until the patient bled to death. I then determined to seek a safer passage to the bladder. After numerous dissections of the parts around the bladder, I was led to adopt the medio-bilateral as the easiest, safest, and best. I have had no reason to change my opinion in regard to it.

Since I adopted this operation I have had, taking all kind of cases, children, youths, adults, and old men (six of whom were over sixty years of age), seventy-four consecutive operations without a death. The next two died. Both of them were young men, aged respectively twenty-three and twenty-four years; both had very large stones. In one, a large pelvic abscess existed at the time of the operation. In the other, phthisis was rapidly developed, and the patient died at the end of three months with the perineal wound unhealed.

I continued to do the same operation, and have had forty-six cases since, with one death. This gives a death-rate of a little less than one in forty. The operation has been equally successful in the hands of other surgeons who have used it. The death-rate of the suprapubic operation is confessedly high. Dr. Dennis, after careful weeding, makes the death-rate one to eleven. Dr. Vanderveer, in collecting his statistics, puts it at twenty-three per cent. Gross, in his great *Surgery*,

states the mortality attending the suprapubic operation to be one to four and a half. Dulles, who has investigated the subject most fully, and has written some most valuable papers concerning it, gives the mortality as one to three and a half; but in a later report he gives a table of twenty cases occurring in the last ten years, with only two deaths. It is shown, however, that the average age of the patients operated on was under sixteen years, and the two deaths were in children of four and two and a half.

This showing is not very encouraging. I cannot, therefore, agree with the distinguished author of the paper that epicystotomy is the safest, easiest, surest, and best cutting operation for the removal of calculi from the bladder.

In answer to the pertinent question of Dr. Vanderveer in his admirable paper, "To what extent can we classify our cases of vesical calculi for operation?" I would beg leave to say that we can, to a considerable extent, arrange cases of calculi in classes, to be dealt with according to circumstances. When stones are not too hard, and when the urethra and bladder are in a suitable condition, litholapaxy should be resorted to; and yet I am sure that if the cases suitable to the rapid crushing operation were submitted to the medio-bilateral method, there would be a smaller death-rate than belongs to the crushing operation. I have performed Bigelow's operation in eight cases successfully, and I still believe that the medio-bilateral operation is easier, quicker, and more successful. When calculi are too large to be extracted safely, and when they are too hard to be fragmentized and removed through the perineum, they should be removed by the suprapubic method. In all other cases, in my opinion, the medio-bilateral operation is to be preferred.

Dr. D. Hayes Agnew, of Philadelphia.

Three operations for stone have been discussed in the papers which have been read. These are litholapaxy, the suprapubic operation, and the perineal method. As Dr. Briggs has said, we cannot commit ourselves positively to any one operation. Every case must stand by itself. With reference to the suprapubic operation, I have always said that I did not see the advantage of going on top of a house to get in, when an entrance can be had on the ground-floor. There are four conditions which I believe are favorable to litholapaxy: an adult patient, a good sized and tolerant urethra, a soft stone, and the absence of any

great degree of cystitis. The median operation is undoubtedly the safest of all operations through the perineum. Nothing of any importance is divided in this operation, and the only damage that is likely to be done is to the neck of the bladder in the extraction of the stone. This laceration and bruising can be avoided by making a little nick on either side of the neck of the bladder. It will then admit of extension to almost any degree necessary for the removal of an ordinary stone. Where, after exploration, the stone is found to be one of considerable size, and yet is one that should come through the perineum, I think that it would be better to combine with the median operation this incision upon either side, a kind of bilateral of the neck of the bladder, thus converting what would be a lacerated wound into an incised wound, or make the ordinary lateral division of the perineal structures. Incised wounds are necessarily less serious than lacerated wounds.

Another point in favor of the perineal operation is the favorable position of the wound for drainage. With the application of the antiseptic method of operation, the perineal section will, I think, be more successful than it ever has been. The instruments should be kept in antiseptic solutions. The injections of mucilaginous fluids which were formerly used should be substituted by a very weak solution of the bichloride of mercury. We have in this a factor which will add much to the success of either the median or the lateral operation.

That there are cases which involve the necessity for the suprapubic operation there can be no doubt. These are cases in which the stone is of great size, and these should, I believe, be removed above the pubes rather than through the perineum. It is, however, rare to meet with stones of that magnitude.

When statistics have accumulated, and we come to the final summation of this matter, the profession will, I think, settle down to the old operation through the perineum. At the same time we should not hastily decide against the suprapubic operation, for I believe in trying all things, and holding fast to that which is good. When a man operates, as Dr. Briggs and others of us have done, year after year, through the perineum, and with almost uniform success, there is little disposition to give up what we believe to be a well-tried method, for one which has yet to command the general confidence of American surgeons.

DR. J. R. WEIST, of Richmond, Ind.

My experience in the removal of stone has been so limited that I feel a hesitation in saying anything upon the subject before surgeons of such large experience. I had operated for stone a few times before seeing Dr. Briggs perform his operation by median bilateral lithotomy. I was so well pleased with his operation that I determined to try it. Since then I have had only a few cases of stone, but I have operated in each case by this method. All the patients recovered, and I am so well pleased with my success that I am indisposed to change an operation which so far has given me entire satisfaction, for one which I am led to believe, from the descriptions given in the papers read, requires more care, and a higher degree of skill in its performance. I observed that in the paper of Dr. Dennis, very specific directions were given as to the method of making the incision; that there was danger of going too far upward, and danger of coming too near the pubic bone. The whole description left the impression on my mind that it was an operation requiring great precision and care. My limited experience would lead me to believe that such exact care is not necessary in the median bilateral operation.

With one exception, all my patients have been old. I have removed a mulberry calculus, weighing 520 grains, from a man twenty years of age. The next youngest patient was fifty-nine years of age. In this case I removed eight stones, weighing altogether over 2000 grains. Another patient was seventy-two years old, with twenty-two stones. From another patient, sixty-nine years of age, I removed five stones. In the last case operated on, the patient from whom I removed eight stones, uniform in size, and weighing in all over 2000 grains, no urine was passed by the perineal opening after the fourth day, and by the twelfth day the wound was entirely healed.

While there are cases of large stone, in which the suprapubic operation may be demanded, yet for all ordinary stones I am led to think the median bilateral operation is preferable, and from my observation and from the papers read, I am inclined to think that it is a safer operation than the crushing of stone. In the paper of Dr. Vanderveer, one or more cases were reported in which a post-mortem examination showed that despite very careful washing out of the bladder some fragments were left in it. I think that we shall find that a return of the stone is more likely to follow the crushing than the cutting operation.

Dr. William A. Byrd, of Quincy, Ill.

I have for a long time been treating old, close strictures by perineal section, and I should not expect to lose a patient from this operation. In case of stone, the introduction of an instrument, and crushing the stone, will avoid all irritation and bruising. If you visit Sir Henry Thompson in London, you will find that he has a number of watch-glasses filled with fragments of stones removed by crushing, some having been crushed through a perineal opening. With the improved instruments for crushing that we can obtain now, I should certainly hesitate before making the high operation, where the drainage would necessarily be very imperfect.

Dr. H. H. Mudd, of St. Louis.

I have performed the lateral operation with good results, but with the introduction of litholapaxy there came to the profession a revulsion of feeling which has robbed the lateral and median operations of a great number of cases. This accounts for the renewed interest in the suprapubic operation. It is a valuable operation for exploration, and for the removal of certain large stones, but that it is better than the lateral or median operation for small stones, I much doubt. The greatest objection which has been presented to the perineal operation is the danger of injury to the prostate, and the possibility of causing sterility. This danger, I think, has been somewhat exaggerated.

There is a class of cases which should have been referred to in the papers, in which there has been long-standing cystitis with contracted bladder. I have in my cabinet a bladder which held a stone weighing 400 grains, which could not have held more than two ounces of fluid. The bladder-walls were at least one-half or three-quarters of an inch in thickness, and so rigid that they would break before they yielded. In this case they could not have been distended so as to raise the anterior fold of peritoneum above the pubes. The bladder could not have been reached except by dissecting up this fold. In another case in which I made a post mortem, in an old man who had suffered for many years with stricture of the urethra, I found an exceedingly hard, firm, and contracted bladder, instead of the dilatation which we sometimes find. I am satisfied that that bladder could not have been reached by the suprapubic operation.

Let me relate the history of a case which recently came under my notice. It was that of a man who fifteen years ago was shot in the

bladder through the gluteal region. The bladder had been explored by the perineal operation but nothing was found. Examination by the rectum showed an induration along the bladder toward the base on the left side. There was most severe purulent cystitis. Examining still further, I found an induration above the pubes which extended in an upward direction at least two inches. This was so thick and dense that the end of the sound introduced into the bladder could not be felt through the abdominal wall. Knowing that there was something wrong with the bladder, I endeavored to make a suprapubic operation for purposes of exploration. I found above the pubes a dense fibrous thickening, pyramidal in shape with the apex extending toward the umbilicus. I made an incision in the median line, but the tissues were so rigid that they could not be separated with retractors. The distended bladder could be distinctly felt projecting into the upper portion of the cut. After exposing what I thought to be the bladder wall at least one and one-half inches above the pubes, I opened it and found that I had also entered the peritoneal cavity. I made a free opening into both cavities and passed in my finger to examine the peritoneal cavity, and also into the bladder. I could feel the induration around the base of the bladder, but accomplished nothing by the operation. I had no difficulty in closing the abdominal cavity, and with drainage tube in the bladder the patient recovered.

Here the fibrous induration prevented access to the bladder at the pubes, and the fold of peritoneum in front of the organ was held down to within an inch of the pubes, although the bladder was freely distended with more than eight ounces of water, and could be felt resting against the abdominal wall for at least three and one-half inches above the bone.

These three cases illustrate a class of cases which may present themselves in which the suprapubic operation might be selected and the operator be disappointed in the results. I admit the value of the suprapubic operation for many cases. The lateral and median operations are valuable except in the cases of large stones, but litholapaxy has taken their place and removed the necessity for these operations. I have found it necessary to operate only twice through the perineum in the last four years.

DR. J. COLLINS WARREN, of Boston.

I have seen two cases of the suprapubic operation within the year. One was for a large stone, the other for tumor of the bladder. There

seemed to be no special difficulty on anatomical grounds. Both cases recovered without a bad symptom. It was not found necessary to use the sound in the bladder to facilitate the operation. The bladder was brought against the abdominal wall by filling it, and distending the rectum with the colpeurynter. I recently had a case which illustrated the advantage of this operation. A patient was operated on by my father, Dr. J. Mason Warren, twenty or thirty years ago by the bilateral method. The patient came under my care at the Massachusetts General Hospital, a short time ago with symptoms of stone. On examination I found a stone in a cul de-sac. This was removed by the perineal section and the patient made a good recovery. This man had ejaculation of semen into the bladder entirely.

Some years ago, I interested myself in the operation of cystotomy in the female. I found that there was no danger of vesico-vaginal fistula. Vesico-vaginal fistula is caused by loss of substance of the vaginal wall to such an extent that the cicatricial contraction is not sufficient to close the opening. It is only in such cases that we get a fistula. Gynecologists have found that incisions through the vesico-vaginal septum heal only too rapidly, and a little button has been made to keep the opening patulous when this is desired. In large stones I should think that this operation might be resorted to, although litholapaxy is a good operation. I should not think that suprapubic cystotomy would be often called for in the female.

Dr. Vanderveer has reported some cases in which, when operating by the Bigelow method, he was unable to remove all the stone. We have not met with this difficulty in Boston. Very large stones, of two thousand grains and over, have been removed in this way. It makes a good deal of difference how the evacuator is worked. If pumped rapidly, the material is thrown back. It should be worked slowly and time allowed for the fragments to be sucked up into the receptacle.

Dr. T. R. Varick, of Jersey City.

I have listened with much interest to the discussion. It strikes me that the size of the stone has been a good deal of a bugbear as regards extraction through the perineum. About two years ago, a boy fourteen years of age was admitted to the Jersey City Hospital, complaining of symptoms of stone. These symptoms had been present for seven years. I operated by the bilateral method. I first started with the left lateral operation, but as the stone was large, I found it neces-

sary to carry the incision to the other side. The stone weighed seven ounces and four scruples, and was as large as an ordinary goose's egg. There was no perceptible laceration and the boy recovered rapidly. This seems to offset the idea of Sir Henry Thompson, that no stone weighing over three ounces should be removed by any perineal operation. This, I admit, was an exceptional case, but it was entirely successful. I operated on December 9, 1885, and on January 30, 1886, the boy left the hospital.

There is another point to which I should like to call attention, and that is, with reference to the control of hemorrhage. I have been in the habit of applying as a styptic and also as an antiseptic, water just below the boiling point. I have used this for eight years and have not seen a case of sepsis in any operation either in hospital or private practice. I take a sponge dipped in water directly from the boiler and pack in the wound for a few minutes.

DR. D. W. YANDELL, of Louisville, Ky.

I regret not having heard the early part of the discussion, for just at this time the subject is of special interest, and what is said upon it here will have much weight when the evidence is finally summed up. I concur, in large part, with my distinguished friend on my left—Dr. Agnew. Although I was not present when Dr. Briggs made his remarks, I know pretty well what he said, for I personally know of his success with the perinial operation. My own experience with the three operations, lithotomy, lithotrity and litholapaxy reaches one hundred and six cases, ninety-two by the perineum, eight by lithotrity, and six by litholapaxy.

I have never done suprapubic lithotomy, and have seen it done but twice. On neither of these occasions, though the operation was done on both by exceedingly clever surgeons, did it impress me as being superior to either the lateral or bilateral method. It did not seem so easy of operation, it clearly required more time, and if injury to the virile powers of the patient is not considered, I was unable to see wherein it was safer. And to-day, with all the reports of success, both at home and abroad, and in spite of the very positive statements of the able men here who have advocated the procedure, I still see no sufficient reason why, in stones of ordinary size and character, I should abandon the methods I have hitherto followed. They have certainly seemed to me altogether sufficient. But seven per cent. of my litho-

tomies ended fatally, and one of these cases died from erysipelas and another from surgical kidney. It is true that most of the subjects were young persons, but still I had a due proportion among old men. In none of them was there a return of the stone. I have been less fortunate in this latter respect with both crushing operations, for I had two returns of stone in my eight lithotrities and two in the six Bigelow's. I take it, however, that the four double operations were made necessary by the want of skill and experience on my part rather than through any defect in the procedures themselves. I was no more successful than Dr. Vanderveer in the extraction of all the stone crushed, and certainly, in the reports just read, he has shown himself a skilful man with both knife and lithotrite.

To my mind the question is still *sub judice*, and must remain so until much more evidence has been furnished. When calculi are too large to be taken out through the perineum, they should certainly be removed by opening the bladder at its fundus, and the procedure is clearly a very safe one. When calculi are of suitable size and in suitable subjects they should certainly be crushed. When they are too hard to be crushed, the surgeon may choose between cutting above or below the pubes, and the choice is necessarily governed by many circumstances, none of which I need enumerate here. I will close with the remark that no one procedure for extracting stone from the bladder is applicable to all cases, and we should congratulate ourselves, therefore, that we possess so many means for accomplishing the purpose.

Dr. John B. Roberts, of Philadelphia.

Yesterday we heard only one side of this question; to-day we hear the other side. Is it not possible that we went a little too far yesterday, and that we are going a little too far in the other direction to-day? I speak with hesitation in regard to this subject, of which my experience has been limited, but I cannot change the opinion which I expressed before this Association, three years ago, that the high operation is certain to be a very important one. No one has discussed the points brought out in the papers, with reference to exploratory operations. The discussion seems to have been confined entirely to a consideration of stone. If there is a tumor in the bladder, or if we desire to make a free exploration of the bladder, the high operation is better than the perineal one. In the hands of the average surgeon, I think that the suprapubic operation for the removal of stone is safer than the perineal operation. If I were to be operated on by myself, for instance, I should

prefer the high operation to the low one. It is safer in the hands of a tyro, or one whose experience in the two methods is limited to as few cases as I have operated upon.

Another important point is that suggested by Dr. Packard's paper, the use of suprapubic cystotomy in cases of retention of urine from stricture. It seems to me that it is too serious a step to take in the first place. My own feeling is that persistent trials to introduce a filiform bougie should be made. If one can be made to pass the stricture, and enter the bladder, and is allowed to remain, the urine will be drained off, and thus will be prevented dangerous stretching or rupture of the bladder walls. If no filiform bougie can be introduced, simple aspiration above the pubes will relieve the bladder, and probably give a chance, in the course of two or three days, for the introduction of some form of catheter. To have two cases of suprapubic cystotomy for retention of urine on one day, has the appearance to me of advocating the operation too strongly.

Another point in regard to the suprapubic operation is that it is more readily made aseptic than the perineal, which is so near the rectum.

DR. J. E. MICHAEL, of Baltimore.

As has been said, the discussion has been confined almost entirely to the consideration of stone. It seems to me that it would be well to discuss the propositions of Dr. Packard with reference to the treatment of retention of urine by suprapubic cystotomy in cases of stricture and prostatic disease. I shall not speak with reference to stone. My experience, which has been small, although entirely successful, has been confined to the perineal operation. With reference to suprapubic opening of the bladder for retention due to stricture or enlargement of the prostate, it seems to me that Dr. Packard has shown a tendency to swing a little too far in the direction of suprapubic incision. I have had more or less experience in dealing with this class of cases. Up to the present time, I have never had occasion to open the bladder above the pubes. The opening on the "ground floor," as Dr. Agnew has expressed it, seems to me to have decided advantages over the suprapubic section. If I remember correctly, Dr. Packard referred to several cases in which the suprapubic section was made for prostatic retention, and to several cases in which it was done for retention due to stricture. In some of these cases the operation was done for the

temporary relief, and later in the prostatic cases, the patient was taught to use the catheter, and in the stricture cases perineal section was made. I think that suprapubic aspiration is all that is needed, and with certain precautions is safe where temporary relief is required. The true indication in enlargement of the prostate is to teach the patient to use the soft catheter. In proper cases this will accomplish all that can be hoped for, unless we proceed to some radical measure as adopted by Mr. Reginald Harrison and others, and remove a portion of the gland. Of course, there may be some exceptional cases in which the suprapubic operation is necessary. Where the retention is due to stricture, suprapubic cystotomy simply necessitates the patient undergoing two operations instead of one. In order that the patient may live comfortably, it will ultimately become necessary to treat the stricture. It seems to me much more conservative to perform the perineal operation at first, even if it has to be done without a guide, relieve the retention, and treat the stricture.

With reference to the suprapubic operation for exploratory purposes, for certain exceptional cases of prostatic disease, and some exceptional cases of foreign body, there can be no question that it is a proper method. For ordinary cases, however, and in fact for nearly all cases of prostatic trouble, and all cases of gonorrhœal and traumatic stricture, perineal section is the best operation. You have one operation, instead of two. There is good drainage, and the wound is in a better position for the patient. I have had occasion to perform this operation without a guide nine times, and so far I have not had a patient die from anything that had any special reference to the operation. The patient who died nearest to the time of operation, died six months after the perineal section had been made. The cause of death was tuberculosis of the lung and bowel. I am inclined from my own experience and that of others, to look upon the perineal operation as more conservative than the opening of the bladder above the pubes, making exceptions in favor of the latter operation, in the cases referred to.

Dr. Vanderveer. I should like to make a few closing remarks with reference to my own paper, and say a few words in reference to the paper of Dr. Packard. I believe that the remarks of Dr. Roberts and Dr. Michael are correct. In the past eight months, Sir Henry Thomp-

son has advised the suprapubic operation for the purpose of exploring the bladder. During the past three years, I have had occasion to examine the bladder through the perineum twice—once for tumor, and once for chronic cystitis. If I had this to do over again, I should select the upper operation.

With reference to the cases of litholapaxy which I have reported, I would say that antiseptic precautions were adopted as far as was possible. The solution for washing out the bladder consisted of one drachm of boracic acid to one pint of warm water. Dr. Warren speaks of having had no trouble in washing out all the fragments. I am aware of that, and report only one case of failure. The second case was the one in which the Keyes lithotrite broke, and perinal lithotomy was at once performed. At this time I had at my disposal six instruments, and the Bigelow improved washing out apparatus. The stone was readily crushed, but the mass in the bladder seemed to mat together, forming a sort of cement, and after working for an hour, I felt it my duty to perform perineal lithotomy.

Dr. Yandell has, I think, struck the key-note in this discussion. What is said here will go out as authority on this subject for the coming year at least. The paper has brought out that discussion which I wanted to elicit. Dr. Agnew has given us the points which come from a man of large experience, on whose judgment we must rely. I do not advocate the suprapubic operation, except for large stones. My first case should have been operated on by the suprapubic method. The stone was large, weighing six ounces. That man, in all probability, had a contracted bladder.

With reference to the perineal route, five of the six cases operated on were by the medio-lateral method described by Dr. Briggs. I used the rectangular staff, and I think that I should use that every time; with it you can reach the point of the prostate, and make the lateral incisions without difficulty.

Dr. Warren has called attention to the fact that in litholapaxy the washing out of the bladder must be done slowly. This is essential. With regard to this operation of litholapaxy, we have a great deal to accumulate in the way of statistics with reference to the return of the trouble. We should collect these statistics as rapidly as possible.

Dr. Briggs speaks of perineal lithotomy with a great deal of energy, and states that if the stone is large it can be crushed. Why is it that Dolbeau's operation, which was so thoroughly worked up by Dr. Gouley, of New York, has not advanced? Aside from Dr. Gouley, I think

that few have used it. Crushing a stone through the perineum is a dangerous procedure. If the stone is large and hard, great injury may be done to certain parts.

With reference to the treatment of the wound of the bladder in the suprapubic operation, Sir William MacCormac insists that the wound should be closed primarily. This is somewhat different from the advice of Dr. Dennis.

With regard to the extravasation of urine in the suprapubic operation, I do not believe that it is likely to occur, if the operation is done according to the rules laid down at the present time.

I have had a few cases of retention of urine from traumatism to the urethra, and from tight stricture, where I have used the aspirator without difficulty. In tight stricture, I think that the aspirator is better than suprapubic cystotomy. It will answer until we get through the stricture, and we can always get through.

I think that we have much to be pleased over, in that we have had a good discussion, and personally I have gained a great deal of information.

THE PROCESS OF REPAIR AFTER RESECTION OF THE INTESTINE AND INTESTINAL SUTURE.

BY J. COLLINS WARREN, M.D.,
OF BOSTON, MASS.

THE following experiments were performed chiefly for the purpose of studying the process of repair as exemplified by the peculiar conditions which surround a wound of the intestinal walls, but also with the hope of contributing something of interest, and, perhaps, of value, to the surgeons and investigators who are now occupied with this interesting field of surgery.

The operations upon animals were performed in the Physiological Laboratory of the Harvard Medical School. Strict asepsis was not attempted in all cases, partly because the tolerance of the peritoneum of dogs is so great that precautions are not necessary to secure prompt union of the bowel and abdominal walls, and partly because it was desired to observe the effects of localized inflammation upon the function of the sutured intestine.

As a rule, the abdomen was shaved and scrubbed with a one per cent. solution of carbolic acid, or a one to five thousand solution of bichloride. The animal was covered with towels wet in the bichloride solution, and the portion of abdominal wall left uncovered was sprinkled with powdered iodoform. Sponges were kept in a hot bichloride solution, and instruments in the carbolic solution.

Females were usually selected for these experiments, as it would have been well-nigh impossible to keep an aseptic dressing upon this region of a male.

The omentum was either drawn up, or an incision was made

directly through it. The bowel to be resected having been drawn out through the wound, was held by the hands of an assistant, and protected with hot cloths and sponges. The segment selected for removal was about two to three inches in length usually, and included the area supplied by one mesenteric branch. A ligature was placed around this vessel at its origin, and the intestine and a V-shaped portion of omentum were severed by the scissors. The anastomosing branches were then secured by ligature. These branches can be also conveniently tied before resecting the bowel.

The material used for the suture was the finest sewing silk, armed with a needle fitting closely upon it.[1] The needle is better short, as an unduly long needle is apt to bend or break. As it is not the purpose of these investigations to test the value of any particular form of suture, it will not be necessary to refer to the different varieties that have been invented from time to time.[2] The "interrupted Lembert" was used in nearly all the experiments. On two occasions a suture devised by Dr. H. W. Cushing, of Boston, which he describes as the "right-angled continuous suture," was employed.

It was not attempted in all cases to penetrate the submucous fibrous layer, as recommended by Halstead, and in but one instance was there a failure to hold the wound, by which is meant that one only of all the stitches taken failed to hold. There did not appear to be any difficulty in avoiding perforation of the mucous membrane; no signs of such an occurrence were observed in any of the specimens.

The first stitch was taken through that portion of the bowel which had no peritoneal covering, namely, that portion lying between the reflected layers of the mesentery. The sutures were continued around the bowel at intervals of about three mm. The mesentery was then sewed with the ordinary interrupted suture.

Suture of the intestine, as has probably been observed by every experimenter, is much more difficult in dogs than in the

[1] "Parabola gold-burnished Sharp's, No. 10."

[2] Boston Med. and Surg. Journal, January 6, 1887. Dr. Otis K. Newell.

human subject, owing to the tendency to extreme eversion of the mucous membrane, due to the powerful retraction and contraction of the longitudinal and circular muscular layers. This is, at times, sufficient to close the lumen of the bowel so that the contents escape with some difficulty. After a little experience, fifteen minutes were found amply sufficient to perform the suture.

Occasionally it was found necessary to reinforce the sutured wounds at one or two points, but as this involves the curling in of a deeper rim of inverted wall, it is as well to make the first row of sutures as accurate as possible.

The suture complete, the bowel was carefully washed and returned as nearly as possible to its natural position in the abdominal cavity.

No suture of the omentum was made in case it had been cut through. The abdominal walls, including all the layers, were then brought together with stout silk sutures, about eight in number, and the edges of the wound were more accurately adapted here and there with a few superficial sutures. The wound was then dusted freely with iodoform, after a thorough washing, and was either allowed to remain uncovered or was dressed with borated cotton, held firmly in place by a double spica bandage, which was firmly sewed together. This dressing was not changed for a week, but iodoform was dusted on daily around its edges.

In all cases the wounds united by first intention; there was, however, a tendency to suppuration about those sutures which were uncovered by a dressing. No difficulty was found in getting good antiseptic results when all precautions were carefully followed out.

The treatment consisted in starvation for three days, followed by an almost exclusively milk diet.

The following cases have been selected to show the process of repair, under varying conditions, during six months following the operation. In no case did the animal die of the operation.

THREE DAYS.—Bull terrier bitch, medium sized; no antiseptic precautions; about one inch of small intestine resected. The continuous Lembert suture was used, one needle and thread only being employed for intestine and mesentery. A little iodoform was dusted on before and after closing the incision in the abdominal wall. The animal was fed on milk, and did well, bowels acting normally; in three days the animal was destroyed. The wound of the abdominal walls was clean and without discharge, having been kept in good condition by the animal itself; on pressure, a drop or two of slightly reddish serum could be pressed from the openings of the sutures. The walls were firmly united; the bladder, which was distended at the time of the operation, was adherent to the inner surface of the wound.

The sutured point was concealed by a mass of indurated and matted omentum, which laid over it and glued together several adjacent coils of intestine. No sign of the sutured mesentery could be seen. The intestines, though coiled and twisted together, admitted water to flow freely through the lumen.

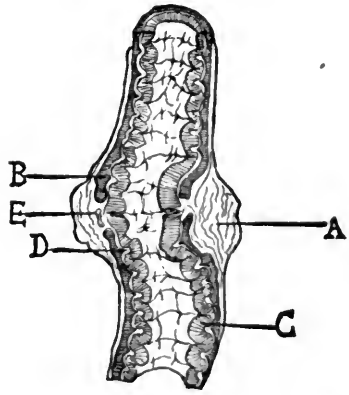
EIGHT DAYS.—Medium-sized mongrel bitch. Fair antiseptic precautions; incision in median line; omentum drawn up, and two inches of intestine resected. Ends of intestine united by Dr. Cushing's continued suture. It is interesting to note that, after this suture is completed, no sign of the thread can be seen. A continuous suture of mesentery was also made. An antiseptic dressing was applied after closure of abdominal wound (iodoform, boracic cotton, and bandage).

At the autopsy the omentum was found adherent to and concealing the line of suture; slight matting together of an intestinal loop by a mesenteric adhesion. The lumen was pervious, and union of the sutured intestine was firm and complete.

EIGHT DAYS.—Medium-sized mongrel bitch. Resection of about four inches of intestine, with corresponding mesentery. Ends of intestine united by interrupted Lembert stitches, and mesentery united by continued suture. The animal had no bad symptoms.

At the autopsy it was impossible to find the exact seat of suture, owing to an extensive matting together of the intestines, which were coiled together in a large lump around the resected spot. It was only after much tearing apart and cutting of the adhesions that the point of suture could be found. The specimen (Fig. 1) from this animal shows a thickening of the peritoneal covering over the line of excision in the form of a callus.

FIG. 1.



LONGITUDINAL SECTION OF INTESTINE EIGHT DAYS AFTER SUTURE, SHOWING AN EXTERNAL CALLUS. THE MUSCULAR COAT HAS RETRACTED SLIGHTLY, AND NO INTERNAL RIDGE IS SEEN.

A. Thickened peritoneum.
B. Muscular coat.
E. Suture.
D. Fibrous coat.
C. Mucous coat.

FOUR DAYS.—Longitudinal wounds were made in the intestine of a dog at short distance from each other, two of these being linear incisions, and the third made by cutting out with curved scissors a portion of the intestinal wall. One was united with the interrupted Lembert suture, the other by continued sutures. On stitching the last wound the calibre of the intestine was greatly reduced in size, so that an instrument not larger than a No. 12 English catheter could have been passed through it.

Considerable matting together of the intestines was found at the autopsy, but the lumen at the narrow point seemed to have been restored. On laying open the intestine threads of the continuous suture were found hanging from the wound into the intestinal canal. There was a hole in the intestinal wound from which a portion of the intestine had been removed extending through the walls of the bowel. There was no protrusion of the coat of the intestine inward; on the contrary, a distinct furrow was found in the mucous membrane marking the line of the wound in each case.

Nine Days.—A large bitch; antiseptic precautions. Incision through the omentum. About two inches of intestine resected, together with a V-shaped portion of mesentery. Mesentery first sewed up with continued suture, and the intestinal ends united by an interrupted Lembert suture. The animal suffered considerably, necessitating two subcutaneous injections of morphia, after which there were no bad symptoms; the bowels acted well before it was destroyed.

No signs of adhesive peritonitis; the line of the suture in the mesentery was distinctly seen, and the intestine at the point of suture was easily separated from the overlying omentum. There was no narrowing of the calibre of the intestine. At the point of suture a faint wrinkle merely of the mucous membrane marked the line of the incision.

The specimen shows the results obtained by a carefully adjusted suture, not including too much of the intestinal wall, and the careful asepsis preserved.

Eighteen Days.—Irish setter; antiseptic precautions. An incision was made in the median line, the omentum drawn up, and a piece of intestinal wall about one inch long and three-quarters of an inch wide was excised with curved scissors. The edges of the wound were united longitudinally with the continuous Cushing suture; owing to the retraction of the circular fibres the calibre of the sutured gut was reduced to the size of a pen-handle when returned into the abdominal cavity. Two inches lower a smaller piece was removed, and the edges brought together transversely by the same suture. Antiseptic dressing, which was changed on the eighth day, when the stitches of the abdominal wound were removed, it having healed firmly.

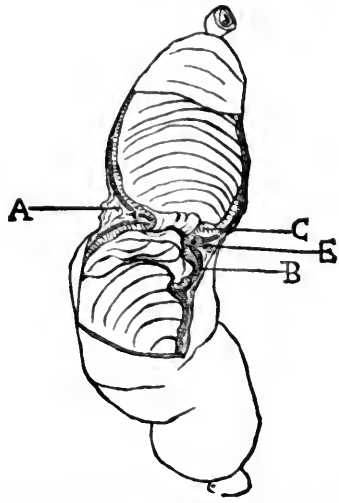
The animal was destroyed on the eighteenth day, being in good condition, passing feces, and feeding well. An adhesion of the omentum was found at one point of the intestinal cicatrix. Some adhesions were found on the mesentery, which folded that part of the intestine, including the two wounds, into a long, oval loop. The narrowing of the first wound still remained nearly the same as at the time of suture, and there was a distention of the bowel immediately above by accumulated food. The other wound had united so neatly that the size of the intestine was perfectly preserved, and it was with some difficulty discovered.

Three Months.—Large-sized, male pointer; antiseptic precautions taken, but no attempt at antiseptic dressing to the wound. About

three and a half inches of intestine were resected at a point about twelve inches from the cæcum, and a corresponding piece of mesentery. Interrupted suture to the intestine, and continued suture to the mesentery.

The wound united well, slight suppuration occurring from the tracts formed by some of the sutures, which rapidly healed on their removal. For some weeks after the operation the animal appeared to suffer pain, and barked almost continuously, at times vomiting food. These symptoms, however, gradually disappeared, digestion became good, and the bowels regularly moved by normal fecal evacuations. It was noteworthy that, though during the last two months of life its appetite was voracious, it did not gain flesh.

FIG. 2.



LONGITUDINAL SECTION OF INTESTINE, THREE MONTHS AFTER SUTURE. A RIDGE OR DIAPHRAGM NARROWS THE CALIBRE OF THE INTESTINE AT THE POINT OF SUTURE.

A. Peritoneal coat.
B. Muscular coat.
C. Mucous coat.
E. Point of suture.

At the post-mortem examination the omentum was found slightly attached at the lower portions of the abdominal cavity; one of the adhesions was attached to the intestinal cicatrix, which was further obscured by a matting of the intestines, not only of immediately adjoining portions of the tube, but also of a loop some twelve inches

nearer the stomach. This mass of matted intestines was in close proximity to the cæcal valve, which, however, was not involved. The mesenteric cicatrix was concealed by the matting of the parts.

On opening the intestine at the point of cicatrization, a high ridge was found encircling the wall, at some points higher than at others. The appearances suggest an unintentional increased inversion of the intestine as the suture proceeded. The diaphragm found at this point, and the extensive adhesions of the intestines no doubt accounted for the symptoms of obstruction which were present during the weeks following the operation.

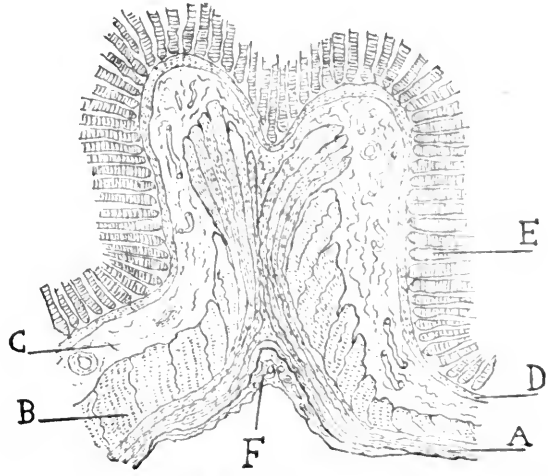
A portion removed for microscopical study showed a proliferation of the peritoneal layer, and also an activity of the cells in the muscular layer. The mucous membrane had closed over the edges (Fig. 2).

Six Months.—Good-sized spaniel (male). The intestine was resected at a point about one foot from the pylorus; no dressing applied. Eight days later the wound, which had firmly united, was reopened to establish the fact of a localized matting of the intestines. On introducing the finger into the abdominal cavity, a hard, irregular, nodulated mass was felt, which was with difficulty lifted from its bed out of the abdominal cavity, it being necessary first to divide numerous omental adhesions. The mass was found to consist of a coil of intestine so adherent that the point of ligature could not be seen. The mass was returned, and the wound closed again. There appeared to be no intestinal obstruction, it being possible to squeeze gas from the intestine above to that below the point of ligature. There was also no appreciable distention at any point. Six months later the animal, which was in perfectly good condition, was destroyed. The abdomen was opened by a circular incision, which included the cicatrix. On lifting this up the intestines were found uncovered by omentum, which had apparently disappeared. It was found, however, that the entire intestinal canal, from the point of suture to the cæcal valve, had escaped through the opening in the omentum which was made at the time of the operation. The intestine could easily be returned through this opening, and it was then found that the adhesions noted as existing one week after the resection had almost entirely disappeared. The omentum, as in all cases, was adherent to the linear cicatrix in the bowel, and a slight narrowing of one portion of the mesentery was observed, due to a cicatricial contraction. The suture in the mesentery was distinctly seen in its whole length. On distending the bowel

with alcohol, and opening it after hardening, a considerable narrowing of the calibre was found at the point of suture, due to so great inversion of the intestinal walls. Owing to narrowing of the mesentery at one point, a kink was formed, when the intestine was distended, and produced a marked spur interiorly, narrowing the calibre at that point.

A microscopical examination of a portion of the cicatrix, removed for the purpose, showed an intimate blending of the bands of longitudinal fibres of the muscular coat, which suggested strongly a union of this coat by a reproduction of muscular tissue (Fig. 3).[1]

FIG. 3.



SECTION OF CICATRIX AT SIX MONTHS (SEE FIG. 2, E). THE VARIOUS COATS HAVE UNITED, EXCEPT THE CIRCULAR FIBRES, WHICH HAVE RETRACTED SOMEWHAT.

A. Longitudinal muscular fibres.
B. Circular muscular fibres.
C. Fibrous layer.
D. Submucous muscular layer.
E. Mucous membrane, shown in part only.
F. Thickened peritoneal layer.

Case of strangulated hernia operated upon by Dr. M. H. Richardson. The hernia was first operated upon five years before by injection for a radical cure. The relief had been complete until the day before the operation by Dr. M. H. Richardson. The sac was opened and

[1] These experiments were performed in the Physiological Laboratory of the Harvard Medical School, with the assistance of Dr. G. H. Monks.

the loop of intestine reduced. The symptoms not being relieved, the abdominal cavity was opened four days later and a reduction *en bloc* found with sloughing intestine. The gangrenous portion was excised with a corresponding portion of the mesentery. The much greater facility with which the suture (the Lembert) could be applied than in the dog was very noticeable, owing to the absence of eversion of the mucous membrane. The patient died twenty hours after the operation. The patient was a female, aged sixty-five. The hernia was inguinal.

At the autopsy it was found that the obstruction which existed during life had not yet been entirely relieved, the upper portion of the intestine remaining distended. Matting of the intestine had also occurred in this case.

Dr. W. Wotkyns Seymour's case of pistol-shot wound of the abdomen.[1] The patient, a boy aged sixteen, was operated upon, about twelve hours after the injury was received, in a basement tenement, but with all the antiseptic precautions. Blood and feces were found in the abdominal cavity. Two inches and a half of the transverse colon were resected, and two wounds in the mesentery were sutured, as also a nick in the duodenum. The patient died at the end of twenty hours. Union was found to be perfect at the autopsy, no leakage occurring through the sutures. There was some evident folding of the mesentery and colon from the adhesive peritonitis, which was stated to have existed in the report of the autopsy.

The following specimens are taken from the Warren Museum to illustrate certain points alluded to in this paper.

Specimen No. 919 shows a matting together of the intestines from adhesive peritonitis or from a congenital condition. The patient was sixty-five years of age, and suffered from chronic diarrhœa and disease of the kidneys. There were no symptoms of obstruction noted in the report of the case in the records of the Massachusetts General Hospital.

Specimen No. 4758½ shows the condition of the intestine of a young man who died more than a year after passing a piece of intussuscepted bowel[2] seventeen inches in length. Persistent vomiting continued afterward, and at the autopsy a constriction was found at the point of cicatrix above which the intestine was much dilated.

[1] New York Medical Journal, August 21, 1886.

[2] Boston Med. and Surg. Journal, December 28, 1876.

Such a specimen as this suggested the possible results that may follow a circular suture of the intestine, should considerable contraction of the cicatrix subsequently take place.

Conclusions.—As it was not the purpose of these experiments to test the different kinds of suture, little need be said on this point. In applying the interrupted suture it was found easy to invert a larger amount of intestinal wall than is desirable, and, as has been observed by other experimenters, there is an increased tendency to invert as the suture proceeds. Neither of these difficulties was met with in the case of resection of the human small intestine reported above. The suture appeared to be much more readily applied in this case owing to the absence of eversion of the mucous membrane, and the greater calibre of the bowel prevented undue narrowing of the lumen.

The right-angled continuous suture when applied is completely concealed and holds the edges of the wound firmly together. It has the advantage of avoiding numerous knots which tend to increase adhesive inflammation, and is drawn tighter by increased distention of the bowel. In the case of any suture, however, which inverts the coats of the intestine a valve-like action of the wound is produced, and the greater the distention of the bowel the more firmly are the edges of the wound pressed together.

In one experiment, not here recorded, the intestine was removed immediately after suture (interrupted) and forcibly distended with water, but no leakage occurred owing to this action. In applying any continuous suture, a certain amount of care and attention is required on the part of the operator to keep the stitches tight during its application. This necessitates the use of one hand solely for this purpose, which, however, does not constitute a serious objection. Moreover, failure to secure firm coaptation at any point can be remedied by applying an interrupted stitch at that spot. The continuous suture, it is rightly claimed, becomes tighter with distention of the bowel, but this supposed advantage, so far as holding the edges

of the wound is concerned, is offset by a tendency to prevent a dilatation of the wounded bowel when relief to obstruction is desirable.

The rapidity with which adhesion takes place tends to equalize the holding qualities of different sutures, they being all rapidly buried under the reparative material.

Unless strict asepsis is preserved, suture of the intestine is followed by numerous adhesions of peritoneal surfaces in the neighborhood of the wound. In some cases this is so extensive as to conceal entirely the sutured intestine, so that it is difficult to find in the mass of matted intestine. It would seem difficult for intestinal contents to pass through such a tangled coil, but in no case was there any material obstruction to the flow of fluid injected at one end. Such a condition may exist in the human intestine without symptoms of obstruction, as is shown by Specimen No. 919, Warren Museum, referred to above. Considerable interference with peristaltic action must, however, exist when adjacent coils are so closely adherent. Should a resection be contemplated at a time when obstruction is already present, as in strangulated hernia, and the indications are not only to remove the sloughing bowel, but also to relieve obstruction, it becomes a question whether intestinal suture or an artificial anus will carry the patient more safely through the crisis.

The conditions favorable for a local peritonitis are already present, and it is probable that adhesions of the adjacent portions of the intestines will, in many cases, take place as in the cases of resection of human intestine reported.

In the case of strangulated hernia the upper portion of the bowel was still greatly distended at the time of death.

When the symptoms of obstruction are the most prominent features of the case and this condition demands prompt and complete relief, it would seem preferable to establish an artificial anus and to suture the intestine later when the conditions were more favorable for recovery.

If strict asepsis has been preserved, little or no adhesion of the bowel or mesentery is seen. This is shown well in the specimen described, where there is no sign of folding or matting

of the intestine and the suture in the transparent mesentery can still be seen (page 146).

In the specimen showing the bowel three weeks after resecting, the mode of casting off of the intestinal suture was observed. The peritoneal surface of the wounds had united firmly, and union of the mucous surface was delayed from being complete by the threads of the continued suture, which, in each case, were hanging from the wound in the interior of the bowel.

This observation suggests the possibility of a delay in the union of the mucous membrane by the casting off of the long thread in the continued suture. In those operations in which only a small portion of the coat has been inverted no ridge was seen in the interior of the gut, but when the amount inverted was considerable the ridge was still observed undiminished in size at three and six months. In the suture of longitudinal wounds of the intestine, this inversion was not observed; on the contrary, a slight groove marked the line of the incision into the mucous membrane.

The inverted coats form a prominent ridge or diaphragm narrowing the calibre of the bowel, and by further contraction of the cicatrix might give rise to symptoms of stricture. Such an unfortunate sequel actually occurred in the cicatrization which followed the healing of the intestine in the case of intussusception reported above. Here we find a circular cicatrix terminating in stricture. Although under ordinary circumstances the wound would not heal in a way to lead to such an unfortunate sequel, it is well to recognize the possibility of such an occurrence if the edges of the bowel are carelessly turned in during suture and excessive local inflammation is not guarded against.

In longitudinal wounds there is also danger of too great narrowing of the bowel, not from inversion of the coats but from loss of a sufficient amount of intestinal wall. In such a case the wounds should be closed transversely instead of longitudinally, the former method resulting practically in a circular suture of the intestine.

Although the peritoneal layer is an extremely thin one and forms a very insignificant portion of the intestinal wall, as seen

in microscopic section, a marked activity of cell-growth is observed on the surface of the coat and the line of sutures, within twenty-four hours probably concealed under newly formed tissue. If the bowel be removed at an early period and sections of a portion of the wound are examined microscopically, a marked thickening of the peritoneal layer will be found enclosing the cicatrix and shutting it off from the peritoneal cavity. A certain amount of cell proliferation will also be found in the other coats, both muscular and mucous. The latter seems to unite promptly, leaving little or no granulation surface exposed in the interior of the bowel. For some weeks after suture the inverted muscular layers lie parallel to one another, but are separated by a line of connective tissue. A certain amount of cell growth may be discovered in these layers, however, during this period. In the specimen examined three months after suture there was evidence of a new growth of muscular tissue in the neighborhood of the cicatrix. In the specimen examined six months after suture interlacing bands of muscular fibre indicated that completed union of the muscular wall had taken place. We found also that the submucous layer was continuous through the cicatrix as a distinct layer. A slight thickening of the peritoneal layer was also found at this period.

The different stages in the process of repair consist, therefore, in a thickening of the outer or peritoneal layer, which covers in the wound even in the mildest forms of reparative inflammation. When the reaction is stronger, adjacent layers of peritoneal tissue are called into aid in protecting the wound, all these external changes subsequently disappear, to a greater or less extent. The mucous coat unites readily, but not completely until the suture is cast off, which event probably occurs about the end of the third or fourth week in the continued suture, and much earlier in the interrupted suture. The repair of the muscular coat is slower still and is not probably complete earlier than the sixth month.

SHOULD LAPAROTOMY BE DONE FOR PENETRATING GUNSHOT WOUNDS OF THE ABDOMEN INVOLVING THE VISCERA?

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My chief object in presenting this subject for your consideration is a medico-legal one. A few years since the counsel for the defence in a famous murder trial asserted that the examination of the track of the ball by a probe in a penetrating gunshot wound of the abdomen, had turned the scale toward a fatal issue, cited many eminent authorities in support of this view, and urged the acquittal of his client of the crime of murder in the first degree. At present, the tendency seems rather toward the most active interference, to operations which in the most experienced hands cannot be denied to have a certain mortality *per se*, and which done promiscuously by those inexperienced in abdominal surgery will undoubtedly tend to render death more certain.

Laparotomy for these injuries has been guardedly endorsed by the American Medical Association, in a most emphatic manner by the New York State Medical Association at its last meeting, and by the Philadelphia Academy of Surgery. Nevertheless, protests have appeared in the journals from time to time, and although I was the first surgeon to venture upon the operation in Philadelphia, yet I feel impelled to ask that you most carefully consider what I advance, and after due

deliberation express an authoritative opinion which may serve as a precedent for appeal. I say an "authoritative opinion," because it cannot be questioned that this body forms the highest surgical tribunal of the country. Some expression for or against this operation, I look upon as imperative both in the interests of justice—that the guilty may not escape under pretense of improper treatment on the part of the surgeon—and that the surgeon may, without fear of censure to influence his judgment, decide for or against laparotomy solely in the interests of his patient.

The questions that must be decided are: What are the tendencies of the injury, are they toward recovery or death? When death takes place, what are its causes? When recovery ensues, what conservative processes occur? How likely are these conservative processes to take place, and what favors or prevents them? How reliable are unaided natural methods compared with those art affords, and should they be imitated by the surgeon or avoided? Finally, what are the dangers inherent to the operation of laparotomy, and what advantages does it offer?

A preliminary consideration of the results of the experiments of Wegner and Grawitz will explain many otherwise inexplicable clinical facts, and clearly indicate the causes of the complications specially dreaded after ball injuries or a laparotomy, and how these dangers can be averted.

The first observer ascertained that the healthy peritoneum could dispose of ordinary air, serum, bile, and healthy urine—any solid particles in these fluids being encapsulated—without any peritonitis resulting. When, however, air and putrescible fluids were simultaneously introduced in greater amount than could be disposed of *within a short time*, decomposition did occur, its products were absorbed and septicæmia resulted. A notable exception was that "living defibrinated blood never decomposed under these circumstances," an observation which seems to prove the truth of my suggestion that the presence of fibrin-ferment, and probably its absorption, is one of the dangers of peritoneal traumatisms.

Grawitz's experiments are singularly in accord with those of the earlier observer Wegner, especially those whereby he proves that even the presence of large numbers of the ordinary forms of microörganisms produces no evil effects so long as the quantity of putrescible fluids does not exceed that amount which can be absorbed or safely encapsuled within a limited time. These experiments prove the truth of the assertions of certain ovariotomists, that operations involving the peritoneum, provided due precautions be taken, are safer than most of those daily performed, since many species of microörganisms can be introduced with impunity into the peritoneal cavity, while even the specific pus-producing forms cannot initiate suppuration except under certain conditions which can usually be avoided. Thus both observers found that "large quantities of the ordinary forms of microörganisms," certain amounts of cholera bacilli, or even of feces, mingled with a putrescible albuminous substance like spleen-pulp, produced no peritonitis in the *healthy* peritoneum, provided the amounts introduced did not exceed that which the peritoneum could absorb or encapsulate, in about one hour's time. When the power of absorption of the peritoneum was impaired, no peritonitis resulted, but septicæmia, if the microörganisms present could induce decomposition of the albuminous fluids. In like manner small quantities of the pyogenic microörganisms, unless the injected fluid was chemically irritating—*i. e.*, could cauterize the peritoneal surfaces—produce no harm, unless the amount somewhat exceeded 10 c. cm.

Suppurative peritonitis, however, was produced by these microorganisms:

"(a) When stagnant fluid was present, capable of nourishing the microörganisms (salt solution, bouillon), the bacteria developing more rapidly than the peritoneum could absorb them.

"(b) When caustic solutions had prepared a field for the growth of the microörganisms by destroying the surface of the peritoneum.

"(c) Especially when a wound of the peritonem was present—even

the hypodermic puncture made in introducing the cultures may be the starting-point of the peritonitis.''[1]

The bearing of these observations upon the subject we are now studying is manifest. Unless free drainage is afforded for all albuminous fluids, despite the exclusion of specific organisms, the presence of the ordinary innocent microörganisms will initiate putrescent changes which will cause septicæmia (sapræmia?), provided the effusions exceed a small amount and the absorbent powers of the peritoneum are impaired. It is in the highest degree probable that this normal absorbing power of the peritoneum *will* be impaired by the shock of a severe injury, a prolonged operation, or the effects of both combined, under which circumstances, unless free drainage is afforded, the effused albuminous fluids become "stagnant," and if specific organisms be present, even in such small quanties as under other circumstances would be safe, suppurative peritonitis will occur, and with additional ease if a wounded surface be present. The lesson to be learned from these observations is unmistakable, and is confirmed by clinical experience, viz., that effacement of all wounded surfaces—*i. e.*, their coaptation by suture—and free drainage, even in the presence of dangerous numbers of pyogenic organisms, will avert disaster.

Practical application of the teachings of these experiments in explanation of the causation of the fatal results of gunshot wounds of the abdomen, and to the technique of laparotomy for the relief of such injuries, clearly indicates that all blood and serum must be primarily removed with the most scrupulous exactness; provision for free drainage for further effusions must be provided, unless there is a reasonable certainty that these will be poured out in such small amounts as to be innocuous; every wounded surface must be coaptated with all attain-

[1] Annals of Surgery, 1887, pp. 120–124, contains a résumé of these experiments, the original articles appearing in Statistischer und experimentell.-pathologischer Beitrag. zur Kentniss der Peritonitis—Charité Annalen, XI. Jahrb., 770 and Langenbeck's Archiv. f. klin. Chir., Bd. XX. i. p. 51. I am indebted to Dr. Curtis's article for my facts.

able accuracy by such sutures and suture-needles as will leave the smallest superficies of injured peritoneum; the drainage opening—if a tube be deemed necessary—must be most strictly guarded; that depression of the circulation present during shock[1]—either of injury or operation—must be removed by appropriate remedies; the vascularity of the peritoneum must be kept as near the norm as possible, to enable its absorbing function on the one hand to prevent suppurative peritonitis by permitting no collection of stagnant fluids to provide pabulum for any pyogenic bacteria which may have gained access to the cavity; on the other hand septicæmia[2] induced by decomposition of the same stagnant albuminous fluids by the mere bacteria of putrefaction.

Having ascertained what experimental research teaches, I shall now endeavor to answer in order the questions propounded, and first, "What are the tendencies of the disease, are they toward recovery or death?"

Examination of the only statistics on a sufficiently large scale shows that a fraction under eight per cent. of recoveries follow after penetrating abdominal wounds; but of this number some doubtless sustained no visceral injuries, as I shall soon show is not uncommon; others, perhaps there were, the walls of whose hollow viscera were penetrated obliquely; others again, in whom the alimentary tract was wounded in those parts which possess an anatomical arrangement unfavorable to the extravasation of their contents.

Thus the walls of the stomach and duodenum are of such thickness, that even when directly penetrated by a small ball there is but little chance of primary extravasation, while when their walls are traversed obliquely there is apparently no tend-

[1] The experiments of Goltz demonstrate that the abdominal viscera, including the peritoneum, are intensely congested in shock, and during prolonged abdominal operations we are all well acquainted with the increased vascularity of this membrane; in such a condition the power of absorption is greatly impaired and probably entirely lost, hence my advice.

[2] Certainly some, if not all of the so-called septicæmias are really sapræmias—*i. e.*, a disease produced by the absorption of ptomaines. When Wegner's observations were made, the subject of ptomaines was in its infancy, hence the term septicæmia instead of sapræmia.

ency at all toward primary escape of the visceral contents. The effects of the rate of speed of the ball, the obliquity of its track, and the anatomical disposition of parts are well illustrated by a case upon which I performed the first laparotomy for gunshot wound done in Philadelphia. The first visceral wound was of the anterior wall of the stomach, and was so small and valvular as to require some manipulation with a director to determine that it was a penetration and not a contusion, neither gas nor fluids escaping on firm pressure on the organ.

The wound of exit was, of course, larger, yet still was water- and air-tight, but, contrary to all expectation, the wound of entrance in the duodenum—and it must be remembered that there is no material difference in thickness of the walls of the duodenum and stomach—was much larger and more ragged than that of exit from the stomach, and freely permitted the escape of the duodenal contents. The actual conditions observed in my own case teach that while a single oblique wound under peculiarly favorable circumstances *may* not give rise to primary fecal, or perhaps even gaseous extravasation, and cure result, yet multiple ball wounds of the gut must necessarily always *admit* of, and probably result in both primary and secondary effusion of the visceral contents, if life be sufficiently prolonged. A single oblique wound of the urinary bladder produced by a small ball may possibly behave in the same manner, but I think not for anatomical and physiological reasons too manifest to require explanation. A wound of the gall-bladder would, under any circumstances, remain patent. In proof of my statement that the abdomen may be traversed by a ball without visceral injury, I need only refer to the four cases reported some years ago by our President, and which I shall presently cite for another purpose. Vomiting of, and the passage of blood may result from simple contusion of the viscera; emphysema of the abdominal wall can readily occur without wound ef the gut, while tympany in the hepatic region is often most fallacious as proof of a wounded intestine.

After penetrating abdominal wounds, as after every other injury, howsoever severe, there are conservative processes initi-

ated, which occasionally succeed unaided by art, yet from an impartial consideration of the above facts, it appears that when visceral wounds undoubtedly exist, the *tendencies* of these injuries are invariably toward death, recoveries being so rare as to be regarded and reported as surgical curiosities.

The escape of the few is only the exception to the rule which, instead of making against operation will, when the process of spontaneous recovery is carefully studied, serve as an additional incentive to laparotomy, since this study will show upon how slender a thread hangs the chance of recovery, and how readily this delicate filament may be strengthened almost to a cable by a skilfully performed operation.

What is the cause of death? Hemorrhage in itself is rarely fatal in any case where an opportunity is afforded for operation, but may occur to a dangerous extent, especially in the young or aged, and that too from vessels of a size to be rightly considered insignificant, were they not situated in a closed cavity. A collection of blood amounting to only an ounce or two may be fraught with fatal consequences, either from the induction of sapræmia, or because it furnishes pabulum for the development of the organisms productive of suppurative peritonitis.

Death, however, is due in nearly every case to septic peritonitis, caused by extravasated flatus, feces, urine, or bile—possibly also by fragments of soiled clothing, as in a case presently to be quoted. Of those attacked with peritonitis due to fecal extravasation, over ninety per cent. die within forty-eight hours. The explanation of some exceptional recoveries is, that the free abdominal wounds resulting from large balls have afforded such effectual drainage for the escaping feces that they have not become diffused throughout the abdominal cavity, while any resulting inflammatory products have likewise readily escaped. I have also already shown that the peritoneum can safely dispose of a limited amount both of feces and flatus.

When recovery ensues, what conservative processes occur? The effused gas or fluids are absorbed without producing either serious local trouble or systemic infection, and a limited adhesive inflammation results, just sufficient to glue the injured

organ to the abdominal wall or a neighboring viscus. It is possible that a wounded liver, kidney, or spleen may heal without adhesion of the wounded organ to the nearest peritoneal surface, but I am unacquainted with any observations bearing upon these points.

Doubtless in some cases adhesions do form, shutting off for a time amounts of poisonous material beyond the capacity of the peritoneum to absorb either in time to prevent suppurative peritonitis or with safety to the organism, but owing to the septic character of the inflammation the adhesions break down and death results. Bearing this in mind, the apparent answer of statistics as to the actual frequency with which conservative processes occur is probably far below the actuality, but so far as the permanency of adhesions and the safe absorption of deleterious matters go, roughly speaking, these processes are succcessful in eight per cent. of the cases.[1] Among the rarest of events in those who recover is the safe evacuation by abscess of the abdominal walls of a small primary fecal extravasation which has become limited by healthy adhesive inflammation, and the same event happening as the consequence of a secondary extravasation taking place among preformed firm adhesions. Far more commonly these so-called fecal abscesses burst into the peritoneal cavity and rapidly cause death in cases which, for a time, bade fair to recover.

What favors or prevents these conservative processes? The absence or slight extent of flatulent, fecal, urinary, or biliary extravasation;[2] the absence or slight amount of effused blood or serum—*i. e.*, stagnant albuminous fluids in the abdominal cavity; a favorable relation of the wounds with reference to the neighboring viscera or the abdominal wall providing for free drainage in the exceptional cases just mentioned; valvular wounds; above all, an aseptic condition of the peritoneal surface of the wounds and their immediate environment, since

[1] Granting the diagnosis always correct; but in some of these recoveries probably neither abdominal nor visceral penetration existed.

[2] See results of experiments already quoted for truth of these and following statements.

without this no reliable, limited adhesive inflammation can occur; and partial or complete arrest of intestinal paralysis—*i. e.*, rest—admitting of the most perfect permanent coaptation of wounded serous surfaces which is feasible, all favor the conservative processes, while the reverse prevents them. Just here it must not be practically overlooked, although the theoretical belief is held by us all, that ball wounds of the abdomen and hollow viscera differ pathologically in many essential particulars from punctured or incised wounds. In the former more or less death of tissue must follow, from which results of necessity an unhealthy inflammation which usually becomes generalized; plugging of the wound by the everted mucous membrane is very unlikely; and effectual coaptation of neighboring serous surfaces, either of the wound or contiguous parts, can rarely occur; in consequence of all these circumstances, natural repair is very rarely permanent. Again, the edges of an incised wound of the mesentery are unlikely to slough, while the track produced by a ball infallibly will, and the dead tissue not being evacuable by the gut, as in a wound of the intestine, will produce fatal results, as has been already reported.

What has been already said sufficiently answers—and that in the negative—the question relative to the reliability of nature's methods as compared with those of art, and the advisability of imitating them. Even the good to be effected by arrest or diminution of normal peristalsis after laparotomy is doubtful, for, having effectually closed all wounds, any adhesion of neighboring organs is unnecessary, and, as a possible source of future trouble, is to be avoided.[1]

The only question now left to answer is, What are the dangers inherent to laparotomy and what advantages does it offer? Shock—due in these cases to prolonged irritation of the abdominal sympathetic—and the risk of rendering a peritonitis septic and diffused, when it might have remained local and

[1] The danger of old or even recent peritoneal bands is too well known to need proof. This view will be productive of good by doing away with one of the chief indications for the enormous doses of opium too often administered in traumatic peritonitis (see Parke's paper also).

simple, are the special dangers of the operation; but, as we have it in our power to prevent a generalized peritonitis from being originated by our manipulations, and to render the inflammation necessarily resulting from the accident comparatively innocuous, shock is all we need dread.

The advantages of operation are manifold. Thus, we can either forestall septic peritonitis or reduce its dangers to a minimum; we can prevent sapræmia—a common cause of death, as I believe—due to the absorption of ptomaines, or perhaps fibrin-ferment; should peritonitis have set in, we can afford efficient drainage for the effusions which may in themselves be already poisonous, or, as we have shown, will assuredly become the chief source of danger; we can substitute for adhesions of doubtful permanency certain methods which secure the escape of the injured portions of gut into the lumen of the bowel; we can prevent the fatal results which must follow the casting off of a decomposing slough of a wounded portion of omentum or mesentery into the general peritoneal cavity; we can arrest hemorrhage, which from its amount will prove fatal, or from its decomposition will equally produce lethal results; we can restore the continuity of the gut, if it be nearly or completely severed, the former condition being not uncommon; we can avoid the risk of fecal fistula, which, had it occurred in my patient, would soon have destroyed life by inanition; and we can remove a hopelessly damaged kidney or spleen, and repair a wounded pancreas or liver.

If then my facts and the deductions drawn from them be true, all ball-wounds of the abdomen involving the intestines, stomach, bile or urinary bladder, should be treated by suture or resection and suture, injured omentum should always be excised and the wounded serous surfaces carefully sutured, wounds of the liver and pancreas treated as I shall presently state, and a wounded spleen or kidney extirpated; provided certain contra-indications, yet to be pointed out, do not exist.

But, it has been urged, every symptom except the escape of feces, flatus, urine, or bile from the external wound, has been demonstrated to be fallacious as a proof of visceral implica-

tion, and that the abdomen has been traversed from side to side without any of its contents being wounded. Granted: but listen to the abstracts of the histories of four cases reported by our President, and ask yourselves the question, "Could these cases have done worse than die, and would not they all have had a fair chance of recovery had the ball, effused blood, cloth, etc., been removed, a careful toilet of the peritoneum made, and effectual drainage instituted?" By the light afforded both by the investigations I have quoted, and clinical experience, but one answer can be given, and that an affirmative one.[1]

A round ball, after travelling beneath the skin for some distance, penetrated the abdomen at the linea alba, passed downward, backward, and to the left, lodging near the iliac bone. No wound or contusion of the bowels could be discovered after death on the third day, but a piece of cloth, lymph, and three pints of reddish serum were found in the abdominal cavity. A conoidal pistol-ball entered obliquely to the right of the umbilicus, tore the parietal peritoneum, and emerged five inches below and to the left of the umbilicus. After death on the third day, no visceral injury was found, but lymph and a large quantity of bloody serum. A soldier "was wounded by a ball from a Shrapnel shell which passed through the cavity of the belly and lodged in the muscles of the back;" another "was wounded by a Minie bullet, which passed obliquely through the wall, entered the cavity for several inches, and then escaped through the anterior wall of the belly." The autopsies of these cases, like those of the two former, showed "peritonitis and the presence of large quantities of acrid bloody serum in the abdominal cavity," a combination of all the conditions experimentally proven to be most fatal—*i. e.*, diminished power of absorption, acrid fluids, stagnating fluids, and wounded peritoneal surfaces, needing no injury of bowel, bladder, or other viscus to destroy life.

[1] Since this paper was read, a successful section has been made where the intestines were found untouched, but all blood, etc., and the ball were removed, recovery ensuing in seven days time. Annals of Surgery, July, 1887, p. 49.

It, therefore, follows that even penetrating abdominal wounds without involvement of viscera, are better treated by exploratory section than by the expectant plan of treatment, provided the operation be done with due care. Moreover, in many instances unsuspected injuries of bloodvessels, contusions of bowel, of omentum, or of the viscera which will later on slough, will often thus be detected and appropriate treatment instituted.

The import of the last few sentences renders it hardly necessary to state that I lay little stress upon the diagnostic signs which are said to be indicative of wounds of the intestines or other viscera, since I believe the diagnosis should be made by the eye alone—*i. e.*, the track of the ball should be carefully enlarged with full aseptic precautions until it is decided whether the peritoneum has been penetrated or not, and if a perforation be found, a median section should be immediately done to ascertain the existence of, and to repair any further damage. Although apparently heroic, this advice is really conservative, since all the rational symptoms of peritoneal penetration and visceral injury have proved fallacious, and if there be no peritoneal wound, what harm can result from the careful aseptic enlargement of the track of a ball wound involving only the abdominal walls? What I have just said is only strictly applicable when the wound of entrance or exit implicates the anterior or lateral portion of the abdomen, for when the ball penetrates its posterior wall, or has first passed through the thoracic or pelvic parietes, it will be inadmissible to determine the fact of peritoneal penetration by direct exploration of the wound or wounds, and the rational signs of penetration will have to be relied upon. Under these circumstances a correct opinion is always most difficult and oftentimes impossible without laparotomy.

I shall only dwell in the briefest manner upon the rational signs of peritoneal and visceral injury, since they will rarely be needed to determine the advisability of operation, and others, notably Bryant, of New York, have treated most admirably of this part of the subject. Of course, the escape of bile, feces, urine, or the contents of the stomach at once settles both the

question of peritoneal and visceral penetration, but these signs are rare even after numerous visceral wounds produced by the small modern balls which commonly cause the gunshot injuries of civil life. Repeated vomiting of considerable quantities of blood almost certainly indicates peritoneal and visceral penetration, although this symptom may be due to contusion, and is unlikely to be present even with numerous wounds, unless one involves the stomach, duodenum, or, perhaps, the jejunum high up; while, of course, in uncomplicated hepatic, pancreatic, renal, splenic, mesenteric, omental, and vascular traumatisms, it is absent. The passage of blood in quantity per anum is also strong presumptive proof, but it so rarely occurs early in the case as to be of little practical diagnostic value for operative purposes.

The presence in the abdomen, within an hour or two of the injury, of a sufficient bulk of fluid to be detectable by physical exploration positively indicates peritoneal penetration, and probably visceral injury, since only intra-abdominal hemorrhage could produce such a rapid accumulation. Some such cases have, I believe, been reported. The rapid supervention of general peritoneal tympany—*i. e.*, an accumulation of intestinal gas in the general peritoneal cavity—is a certain sign of wound both of peritoneum and gut, but to be of any great value it must supervene within a very short time of the injury. It has not yet been noted previous to abdominal sections for ball wounds, so far as I can ascertain. Finally, an amount of hemorrhage which can neither be accounted for nor arrested after a careful examination of the parietal wounds, almost certainly indicates penetration and vascular or visceral injury.

It will be noticed that I have omitted many symptoms usually given, but they have proved so utterly fallacious in many instances as to be unworthy of the name of diagnostic signs. Shock preëminently belongs to this category.

If we exclude those rare cases where there is only a wound of entrance in an unusual site—for instance, the posterior lumbar region—I feel that it is a far graver question to decide when not to operate than when to operate. I shall only tentatively

point out the contraindications, for I consider that laparotomy for ball wounds is of too recent date for anything beyond provisional indications and contraindications.

Profound shock, provided it be not mainly due to a loss of blood which can probably be rapidly arrested after the abdomen is opened, is an undoubted contraindication. If the greater part of the shock be not due to hemorrhage, the prolonged handling of the bowels, especially in the young or old, is apt, through irritation of the abdominal sympathetic, to produce a dangerous amount of prostration in those whose vital powers have been already depressed by the injury. Such an effusion of blood escaping externally, internally, or in both directions, as would render it probable that the added shock of an operation would terminate life before, or in spite of the arrest of hemorrhage, contraindicates laparotomy. As I cannot conceive of any circumstances where at least a perfectly clean abdominal wall, hands, and instruments are unattainable, with some germicide such as mercuric bichloride, iodoform, subiodide of bismuth, tincture of iodine, or carbolic acid, with at least one tolerably competent assistant, the surroundings of a patient should never contraindicate operation in an appropriate case, provided the operator be experienced in abdominal surgery; for I cannot think that the average practitioner should attempt a laparotomy for gunshot wound. An operation demanding so much care, experience, and attention to detail, can rarely be properly performed by a tyro—*i. e.*, every traumatism discovered—and repaired—without undue loss of time and unnecessary handling of the viscera. If possible, only one pair of hands should be introduced into the abdominal cavity, and those the operator's; so that I contend that inexperience approaches very closely to a positive contraindication.

When a skilled operator cannot be secured, in exceptionally favorable cases the attempt may be made and succeed, but most cases will do better left to nature than operated on by a bungling surgeon, who, from the nervousness induced by inexperience, will, in his hurry, overlook wounds or some of the essential details of aseptic abdominal surgery. In support of

my statement, that experience is requisite for this operation, I would ask you to reflect, how much more difficult it is to open an abdomen with tense and rigid walls, take out, examine, and replace twenty odd feet of intestines, and critically inspect all the abdominal organs, than it is to remove a large ovarian tumor which leaves the parietes lax, thus giving abundance of space.

If, because the patient has been seen too late, a generalized, well-advanced peritonitis exists, laparotomy is strongly contra-indicated, for, since the main aim of the operation is to *prevent* diffused, unhealthy peritonitis, no indication for its performance any longer exists. It is true that abdominal section has been advocated and successfully performed for acute peritonitis, but I do not think it will do aught but harm in cases following gunshot wounds of the abdomen with visceral injury; possibly where no visceral complications exist, it may prove occasionally useful. If it was possible to determine beforehand that only one perforation existed, a laparotomy might be done, and, provided the injured loop of bowel could be found and secured in the abdominal wound and free drainage instituted, good might accrue; but my experience of laparotomy for diffused peritonitis following rupture of the intestines and for ball-wounds, teaches me that it is extremely improbable that we should be able to find the wounded bowel without excessively prolonged manipulation; that the gut would be in no condition to suture; that multiple perforations would be so situated that all the loops of injured intestine could not be secured in the abdominal wound—and if all cannot be thus held so as to discharge their contents externally, what good can the operation do?—and finally that neither free drainage nor an effectual toilet of the peritoneum can be secured. Wounds of the solid viscera will, according to their ascertained or probable severity, serve as contraindications or the reverse.

With reference to the proper time for operation, I can only say that both experience and experiment seem imperatively to demand that laparotomy should be done at the earliest possible moment the condition of the patient will warrant it. Shock

—which is usually not well marked—is all that should withhold us, and not even this if hemorrhage is producing the condition, in which case, as in other severe injuries, the operation must be at once proceeded with, despite the unfavorable condition of the patient, lack of proper assistance, preparations, etc.[1] It is only under such desperate circumstances—and they can but rarely obtain—that we are warranted in operating without having most scrupulously provided for every contingency; for it must be borne in mind that after opening the abdomen, serious hemorrhage may be found arising from the liver, kidney, pancreas, or spleen, that resections of portions of intestine may be necessary, and I can readily conceive that before long we shall find reports where the splenic or a renal artery has been wounded, demanding removal of the organ whose blood supply will be cut off by the ligature of its nutrient vessel.[2] Present experience seems to demand the adoption of the following precautions. I shall first indicate what should be provided when obtainable, afterward detailing what substitutes can be used in emergencies: First, all pubic or other hair must be removed, the skin of the abdomen, especially that of the umbilical depressions thoroughly cleansed by the free application with a nail-brush, of turpentine 2 parts, alcohol 14 parts, which application must be thoroughly removed with the nail-brush, soap, and warm water, and a cloth soaked in mercuric bichloride solution laid over the abdomen while the patient is being etherized; indeed, when circumstances will admit, all the cleansing had better be done before etherization. Washing the parts with ether, alcohol, antiseptic, or plain soap and water, and the application of a cloth wet with carbolic acid solution, thymol, salicylic or boracic acid solutions, or a very weak iodine tincture solution will do in an emergency. Abundance of freshly distilled recently boiled water should be at hand, some kept hot, some cold, with a large fountain syringe for flushing the abdominal cavity. This water can be usually readily obtained

[1] Shock arises in most instances of ball-injury from hemorrhage, or, at least this is my opinion.

[2] See Dr. Keen's case, p. 193 of this volume.

from the condensed steam collectable from the steam-heating apparatus of most hospitals, needing nothing but filtration and boiling to insure its sterility. If this is not obtainable, one part of mercuric bichloride to ten thousand of water, one part of carbolic acid to five hundred of water, or larger proportions of water may be used, the water boiled, allowed to settle, and decanted for use. I look upon the addition of these germicides simply as insuring the sterility of the water, not that they are to kill germs already present in the abdomen, or which gain access to it during operation ; none of these should be allowed to enter, and any that do must be mechanically removed by a proper toilet, and above all by the free flushings of the cavity with this sterilized water. Used thus, I believe germicides do good, but in anything like full strength I look upon them as only harmful.

In like manner, the sponges, towels, and instruments should be first carefully cleansed with soap and water—to which carbolic acid may be added, if desired—and then placed in the hot sterilized water. Special attention should be paid to the cleansing of the handles of instruments, which, if roughened, must be thoroughly scrubbed with the nail-brush. The operator's and assistant's hands and finger-nails should be most scrupulously cleansed with the nail-brush, etc., and the sterilized water, or an antiseptic solution. Six aseptic sponges should be provided, three of which should be on handles, or held by sponge-holders. When soiled, they should be first cleansed in one vessel, and then rinsed out in fresh water before being used again. A number of soft old linen or flannel cloths should be handy, lying in the hot sterilized water, to envelop the intestines in. I would suggest that as few instruments as possible be used, viz., one scalpel, a probe-pointed knife, a director, one tenaculum, one aneurism needle, two fine sewing needles, threaded with fine pure silk, another coarser, and threaded with dry aseptic gut, two ordinary surgical needles, threaded with heavy silk, half a dozen hæmostatic forceps, a thermo-cautery, one pair of scissors, and abundance of silk and catgut ligatures, all kept beneath the sterilized water, or in a carbolized solution,

according to the surgeon's preference. Whenever the instruments or sponges are not in use, they should either be rinsed off, and then placed in the sterilized water, or laid upon a clean towel, wrung out in the same. Every instrument, needle, sponge and cloth, must be counted *before* and *after* the operation. A small quantity of either iodoform gauze or plain gauze with its meshes filled with the powder of this drug must be at hand to tampon a wounded liver, spleen, or kidney.

As a dressing, my personal preference is the free application of iodoform to the line of the wounds, and dry absorbent cotton, with a snug flannel binder; but corrosive gauze, subiodide of bismuth, carbolized gauze, eucalyptol, etc., with broad rubber adhesive straps, should be provided according to each one's liking or custom, with such additional instruments as may be deemed necessary. If drainage be used, a glass tube is the most desirable form to employ, but if not obtainable, a large *non-perforated* rubber one can be substituted. A hypodermic syringe with solution of atropia, whiskey, hot water-bags, bottles, or bricks, must also be ready for instant use.

Now as to technique. The patient's limbs and trunk must be carefully wrapped in blankets, with towels wrung out of the aseptic or antiseptic solution, tucked under and folded over them around the abdomen, to prevent any accidental contamination of the peritoneal cavity. If not previously done, the urine should now be drawn off, lest from a bladder wound the fluid become forced throughout the abdominal cavity by the patient's struggles. Ether should be most cautiously administered.

The incision should always be median, as otherwise it is almost impossible to gain a proper view of the parts,[1] and should usually extend from a short distance above the umbilicus to about two inches above the pubes. The abdomen having been opened, any clots of blood which obscure the operating field may be removed, but otherwise, unless it is manifest that severe hemorrhage is going on, the small intestine, which usually first

[1] Neglect of this rule has proved disastrous in more than one instance. See Dr. J. H. Packard's case, where after the toilet had been commenced free bleeding was discovered, necessitating a search deep in the pelvis to find a wounded iliac vein.

presents, should be carefully gone over, inch by inch, from the stomach to the ileo-cæcal valve, keeping it constantly enveloped in towels wrung out of hot water; afterward the stomach, spleen, liver, pancreas, large bowel, kidneys, bladder, omentum, mesentery, and abdominal vessels must be examined. I do not mean that if various wounds are discovered—say in the small intestine—and the place of exit of the ball from the abdominal cavity, all in such relations as would absolutely exclude injury of the stomach, liver, kidneys, spleen, or bladder, that such a detailed examination should be made—far from it, for every unnecessary manipulation is injurious; but I do advise that, rather than overlook a wound, much manipulation which the result proves to have been unnecessary, had better be made. Of course, the source of a severe hemorrhage must be at once sought for, and any wounds of the hollow viscera ignored for the time being, care however being taken that the general peritoneal cavity is protected from fecal extravasation by removing the intestines outside the abdomen, keeping them wrapped in warm, moist cloths; such hemorrhage is, however, most unusual. Whatever plan is pursued, let everything be done methodically, and each injury repaired as it is detected, as this saves much time, and renders any oversight almost impossible. All wounds of the bowel, however trivial, should be minutely cleansed, coaptated by the Lembert suture of fine silk introduced with an ordinary sewing needle,[1] and the suture-line rubbed over with a little iodoform.[2] When necessary from the size or number of the wounds a portion, or the whole calibre of the gut must be exsected.

Wounds of the liver, if situated at the free border of the organ, should if possible be coaptated with dry aseptic gut

[1] This is to secure as small a wounded surface of peritoneum as possible, since the needle-track will be filled by the thread; the importance of this is clear by the light of the experiments quoted. In addition, Dr. J. H. Packard calls attention to the troublesome bleeding resulting from wounds of small vessels by the ordinary suture needle.

[2] W. T. Bull, the most successful operator for ball-injuries, has always used this method of dressing.

which will soon swell and fill the track made by the needles. If this cannot be done, the hemorrhage may perhaps be arrested by the judicious use of the thermo-cautery, but if the bleeding be free, the wound should be plugged with an iodoform gauze tampon which is to remain permanently, or may perhaps be carefully removed at the close of the operation, when, if the bleeding be almost entirely checked, the cautery may then be used as a further precaution—if the flow be free, the tampon must be replaced and allowed to remain permanently.[1]

Wounds of the pancreas, spleen, or kidneys, must be treated in a similar manner, or, if these measures fail, either spleen or kidney must be excised. Since a wounded splenic artery would inevitably result in gangrene of the organ, it must be removed. The same advice holds good for wound of a renal artery, but in these cases death from hemorrhage will usually result before art can intervene; still, such possible complications must be provided for. Wounds of the bladder had better be sewed with dry chromic and sulphurous acid gut, which by its swelling will fill the track of the little wounds, and the needle used should be a round one, as small as can be made to carry the thread. Contused bowel will almost certainly slough, so that the injured portion had better be excised and the healthy peritoneal surfaces united over it by suture.[2] Wounded or contused omentum or mesentery must also be excised, and the edges carefully united by interrupted sutures. The experience of at least one case has shown, that since an omental slough cannot be eliminated into the lumen of the bowel as occurs in wounds of the intestine, a fatal generalized peritonitis will result from the local gangrene of the injured part. All bleeding must be checked, even from the smallest vessels, for quite extensive oozing will occur from most insignificant vascular orifices because they are situated in a closed cavity, and although the amount lost may not be dangerous *per se*, it will prove so as a source of septicæmia or peritonitis.

[1] Recommended by Senn, of Milwaukee.

[2] Parkes contends that the peritoneum can be safely united over the contused spot with a continuous catgut suture, except where the injury involves the mesenteric attachment, when it must be excised.

If a segment of bowel is to be excised, the cuts should be made at such points as correspond to the distribution of a large mesenteric branch, in order to secure a due blood-supply to the edges of the incisions, and the parts to be removed should be laid upon a large, flat sponge, or folded napkins to prevent fecal extravasation into the abdominal cavity. To obviate kinking of the bowel, a V-shaped piece of the mesentery must be removed, the branches of the V not corresponding to the cut edges of the bowel, but presenting a free margin of an eighth of an inch, lest want of vascularity cause failure of union at this, the most doubtful point. After arresting hemorrhage, the mesenteric wound must be carefully coaptated by numerous points of interrupted suture. Now the bowel should be united by the Lembert suture, turning in at least one-fourth of an inch of the serous coat, or by the Czerny-Lembert, Gussenbauer, or other suture, whichever is preferred, although the Lembert, with sufficient inversion of serous coat, is thoroughly reliable.

The first stitches must be placed at the mesenteric border, are the hardest to make efficient, and should be three in number to secure perfect contact of the serous surfaces, as Parkes observes. One stitch directly opposite the mesentery, and a third and fourth equidistant between the first two should then be passed, after which the intermediate ones can be inserted about one-eighth of an inch apart, first carefully inverting the mucous membrane. For special details and numerous ingenious devices I must refer you to the admirable experimental paper of Parkes, and the writings of Treves, Ashhurst, and others.

Should the pulse fail at any time during the operation, owing to irritation and paresis of the abdominal sympathetic, flushing the intestines and peritoneal cavity with hot water will oftentimes at once remove the unfavorable condition. The most scrupulous care must be exercised in the peritoneal toilet, which can be most quickly and effectively made by thorough irrigation of the cavity with warm sterilized water[1] and subsequent careful

[1] Sterilized either by being distilled and boiled, or by adding minute quantities of some antiseptic.

removal of all fluid in the ordinary manner by sponges, especial attention being paid to the cavity of the pelvis, and the renal regions.

When possible, the peritoneum should be carefully united over the orifices of entrance and exit of the ball, just as in the case of intestinal wounds, and a little iodoform rubbed in.[1] Closure of the abdominal wound should be effected by first carefully suturing the peritoneum with fine silk or catgut. This I look upon as most important, since the tenseness of the abdominal walls, so different from the conditions existing after the removal of a tumor, render it extremely difficult to bring the peritoneal surfaces into proper apposition without undue traction on the sutures, thus possibly leaving raw surfaces which may serve as the starting-point of a peritonitis, while, even if not provocative of such serious consequences, a ventral hernia will almost certainly result.

The muscular, aponeurotic, and cutaneous structures should then be carefully coaptated by stout silk sutures, iodoform be freely dusted along the wound, which may be supported by one or more broad rubber adhesive strips, if thought desirable, when a thick layer of absorbent cotton and a flannel binder will complete the dressing. The patient should now be placed in his previously heated bed, with limbs flexed over a pillow,[2] the urine drawn, external warmth applied, and stimulants, such as atropia or whiskey, given hypodermically, if they are indicated. If not, a moderate hypodermic of morphia must be administered combined with a small dose of atropia, and rest enforced.[3]

When incipient peritonitis exists at the time of operation, with the probable formation of large quantities of acrid, septicæmic or sapræmic inducing serum, drainage should in all cases

[1] If the puncture made by the hypodermic needle in experimentation was the starting point of a peritonitis, much more will the wounds be made by a ball. I think this matter has been too completely ignored.

[2] When purulent peritonitis exists, a lateral decubitus is, perhaps, advisable.

[3] I can conceive of cases where transfusion, or the temporary use of Esmarch's bandages to the limbs might be indicated, where death is imminent from severe hemorrhage.

be instituted, for some patients have, I think, perished for want of this precaution.[1] The tube, preferably of glass, should have its end kept well down between the rectum and bladder in the male, or in Douglas's cul-de-sac in the female, with the external orifice plugged with iodoform cotton.

The after-treatment will be considered under three different heads, viz.:

1. When peritonitis does not exist at the time of operation —in other words, when a primary operation has been performed.

2. When incipient peritonitis does exist at the time of operation—*i. e.*, when a secondary operation has been done; and

3. When, despite all our efforts, or due to some neglect in technique, peritonitis develops after operation.

1. Under the first conditions, a recumbent position, with flexed knees, seldom changed—and then not by the patient's efforts—should be insisted upon. Alimentation must be carried on by the rectum entirely, when possible, for at least forty-eight hours, and in some cases even longer, when the stomach is irritable. At the most, cracked ice and small quantities of beef peptonoids should be given when the rectum rejects enemata, or when feeding by the mouth is begun. The higher up the intestinal canal the wounds are, the more imperative the rectal feeding becomes. At the end of a few days, larger quantities of food may be given. Should tympany occur to any extent, the rectal tube and the enemata should be tried. If masses of feces are present or suspected to be lodged in the colon, about thirty to sixty grains of inspissated ox-gall, dissolved in some mucilaginous vehicle, should form the enema, and will sometimes relieve severe tympanites where an ordinary injection will fail, owing to occlusion of the gut by fecal plugging.

2. When a preëxistent incipient peritonitis has necessitated drainage, the tube should be periodically emptied by a syringe with a soft rubber tube attached, the syringe kept aseptic, and tube corked with iodoform cotton. Should the discharge be-

[1] Some of Parkes's experiments exemplify this point.

come large or purulent, one careful irrigation with weak mercuric bichloride solution, followed up by boracic or salicylic acid solution, should be resorted to. With a large amount of discharge, a lateral or semi-prone position, which will favor drainage, is advisable when the patient can assume either attitude.

Neither much food nor alcoholic stimulants will be needed even in this condition, since either the patient will die before true exhaustion demanding large quantities of aliment and alcohol comes on, or recovery will ensue. As will presently be explained, atropia is better than alcohol for the shock of commencing peritonitis, or the "exhaustion" of the latter stages—*i. e.*, the depression of the nerve centres, especially those of circulation and respiration.

3. When peritonitis develops after the operation, our initial treatment must depend on whether the disease comes on gradually or suddenly. When the latter occurs, there is at times decided evidence of shock from vasomotor paresis, evidenced by an apathetic semi-conscious condition, with extended limbs, pinched features, and a weak pulse—in such a condition opium in large doses will probably prove fatal, while *small* doses of morphia with atropia will relieve pain and stimulate the heart. The heart itself always should be examined by auscultation, since this may demonstrate that its action is really feeble, while the pulse feels hard and wiry. Now, under such circumstances the pain is often severe, but large doses of opium, unless combined with atropia or digitalis, are very dangerous. I say large doses, meaning by this term those ordinarily recommended for peritonitis in the text-books.

Later on, owing to asthenia, the recumbent position, and the compression of the lungs by tympanites, hypostatic pneumonia is apt to develop, when the improperly aërated blood tends to paralyze the respiratory centres. Here morphia must be very cautiously given, or better, in many cases, withheld, and when given at all must be guarded by ammonia, atropia, or digitalis. Stimulating hypodermic injections and revulsives, such as dry cups to the chest, are indicated. When peritonitis

develops gradually, opium can be given more freely, remembering that the ideal condition to be obtained by opium is freedom from pain, irrespective of the quantity of opium exhibited; and when this is secured a patient falls asleep, *but can be readily aroused.*[1]

This last sentence is the keynote of the opium treatment. Morphia had better be the drug employed, and should be given hypodermically, since opium by the mouth is not always absorbed, and may lie unchanged in the stomach or intestines for days to be suddenly taken up in fatal quantity. "In the later stages of peritonitis, especially when the heart and lungs fail, and when gastric regurgitations and hiccough are rapidly exhausting the patient's vitality, one or more hypodermics of atropia, varying in strength from one-sixtieth to one-tenth of a grain each, either alone or in combination with morphine, digitaline, ammonia, or alcohol," according to indication, will at times save an otherwise hopeless case.

In addition, we undoubtedly possess two powerful means of directly affecting the vascular processes involved in a peritonitis. Free leeching done at the commencement of the attack, or when it has not progressed far, is of signal benefit, provided the patient has not lost much blood from the accident. This I have witnessed at the bedside of patients, and also experimentally proved, as may be gathered from my observations on bloodletting read before this Association three years ago. Cold, by means of the ice-coil to the abdomen, is a second means of controlling peritonitis. Cold applied to a peripheral sensory nerve has been shown by physiological experiment to control the afflux of blood to those parts supplied by the vasomotor nerves which inosculate with such sensory branches. In the present instance, the nervous circuit consists of the lumbar nerves, supplying sensory filaments to the abdominal parietes, and the branches of the solar plexus which are distributed to the intestines and peritoneum. Cold applied to the former nerves—*i. e.*, to the abdominal wall—will therefore

[1] Burchard: New York Medical Journal, August 15, 1885.

cause contraction of the bloodvessels of the peritoneum and intestines. It will do more; for it lowers the temperature, relieves tympany, and calms the nervous system.[1]

Should the sutures uniting a resected or wounded bowel have given way, nothing remains but reopening the wound, irrigating the cavity with an antiseptic solution, and the attempt to secure the bowel in the abdominal wound—in other words, form an artificial anus; but practically this question will hardly arise.

Should persistent and rising temperature, despite the ice-coil, etc., be present without the local signs of peritonitis,[2] I should suspect the presence of some fluids which, generating ptomaines, were being absorbed, and producing sapræmia. In such an event, the reopening of one angle of the wound, free irrigation with safe antiseptic fluids of the abdominal cavity, and the retention of a drainage tube managed as I have already directed, would perhaps save some otherwise condemned patients. In the same way, should septic peritonitis arise, with probable effusion of large quantities of fluid, such as are often found after death, I should strongly advocate a similar plan of treatment. Owing to the anatomical position of the kidneys, they are liable to become involved when the peritoneum is inflamed; hence, the use of turpentine is to be deprecated. Burchard states that "more than once has the timely application of cups and a digitalis poultice over the kidneys "saved for him, the life of a patient who was insidiously developing a peritonitis." Daily examinations of the urine should therefore be made, since retention of the urinary excreta in nephritis is a well-known cause of peritonitis. Digitalis in some forms, and perhaps other diuretics are also peculiarly indicated in the sapræmic condition, to aid in the evacuation of the poisonous ptomaines,

[1] Leiter's block-tin coil is, of course, the best means for applying cold, but a few yards of half-inch rubber tubing kept coiled up by means of three equidistant narrow strips of tin so interwoven with the tubing as to keep the coil flat, will prove nearly as effectual and can always be obtained in an emergency.

[2] Provided no symptoms of shock were present, such as I have already described as ushering in a sudden attack of peritonitis.

for if none of these products are allowed to remain in the abdominal cavity, and those already absorbed can be eliminated, recovery will often ensue. I can hardly conceive, as I have already said, of a case of this variety of traumatic peritonitis living sufficiently long to develop enough true exhaustion to demand large quantities of food and stimulants; but should this occur, of course the experiment must be tried, although the stomach will probably rebel.

In conclusion, I wish to repeat that everything advanced must be viewed as more or less provisional, since sufficient experience of the operative treatment of these cases has not yet accumulated to warrant positive statements.

PISTOL-SHOT WOUND OF ABDOMEN TREATED BY LAPAROTOMY AND SUTURING THE INTESTINES.

BY R. A. KINLOCH, M.D.,
OF CHARLESTON, S. C.

JOSEPH B., colored, aged twenty-seven, was admitted into the City Hospital, January 21st, at 7.30 P.M. He had, two hours before, been shot in the abdomen with a pistol-ball (38 calibre), by a policeman, with whom he was struggling at the time. The ball had entered an inch and a half to the left of the umbilicus. There was also a slight wound of the scalp, supposed to have been received by falling after being shot. There was but little shock; patient seemed comfortable, with the exception of pain on the inside of the left thigh, which was intensified by movement of the limb. Pulse was 88, respiration 24, temperature 99°. He was given by the house-surgeon forty drops of tincture of opium, put to bed, abdomen carefully washed with a solution of bichloride of mercury (1 : 2000), iodoform sprinkled upon the wound, a compress of cotton placed over this, and retained by an abdominal bandage.

I visited the patient an hour after his admission into the hospital, and immediately directed the preparations for laparotomy. At 10 P.M., the preparations being complete, half a grain of morphia was given hypodermically, and soon after anæsthesia was induced by the A.-C.-E. mixture. The little finger was first passed into the wound, and subsequently a Nélaton porcelain ball-probe, to verify the fact of the entrance of the projectile into the peritoneal cavity. The cavity was then opened into by an incision eight inches in length, upon the median line, extending from the umbilicus to just above the pubes. The incision was made under a weak carbolic spray. The intestines were carefully drawn out and examined piece by piece. Soft, clean towels, wrung out of a warm solution of bichloride of mercury

(1 : 10,000), were used for covering the intestines as the examination proceeded. The jejunum was found to have four perforations—two were orifices of entrance and two of exit. The ileum had two perforations—one of entrance and one of exit. The mesentery was perforated in two places, and was besides badly torn. One of the vessels of the mesentery was bleeding freely. The hemorrhage was at once controlled by pressure-forceps, and subsequently by a fine silk antiseptic ligature. There was a considerable amount of blood, fluid and clotted, in the cavity. All the wounds were closed, without paring, by means of a delicate, round, smooth, straight needle carrying fine antiseptic silk, forming the Lembert suture. The large wound in the mesentery was as carefully brought together as possible, but it was noticed that at this point there was an extensive infiltration of blood which could not be removed. The cavity was carefully cleansed, and washed out with the weak solution of bichloride of mercury.

Much difficulty was experienced in returning the intestines into the cavity, because of the rigidity of the abdominal parietes. The abdominal wound was closed by deep silver wire sutures, and superficial sutures of fine antiseptic silk. A large rubber drainage tube was inserted, and the wound dressed with iodoform, cotton, and a sublimate bandage. During the operation, which was necessarily protracted, three hypodermic injections of sulphuric ether and tincture of digitalis were administered. The patient was in very good condition when removed from the operating-table to his bed. Now another hypodermic of half a grain of morphia was given. Cracked ice in small quantities was allowed.

January 22, 6.30 A.M.. Pulse 108, respiration 36, temperature 101°. Allowed a spoonful of milk and lime water occasionally, if not nauseated. Morphia, if required to relieve pain and insure quiet. Incontinence of urine was noticed. At 5 P.M., pulse 118, respiration 25, temperature 100°.

23d. At 12 midnight, pulse 108, respiration 32, temperature 100°. 3 A.M., pulse 118, respiration 32, temperature 102.9°. 6 A.M., pulse 104, respiration 28, temperature 101.4°. At 8.30 A.M. vomiting occurred. I visited the patient soon after this, and upon examining the drainage tube and wound, found that one of the wire sutures had broken, and a small knuckle of intestine was protruding through the middle of the wound. There had been some bloody serum discharged through the tube. I disinfected the wound, carefully returned the

intestine, and closed the gap in the wound by a stout antiseptic silk suture. The patient made no special complaint of pain. Drainage tube was removed. Small quantities of peptonized milk allowed, if the stomach should be quiet. Morphia, if necessary.

At 2.30 P.M. pulse 120, resp. 20, temp. 102°.

At 5 P.M. pulse 108, resp. 25, temp. 102°.

At 9 P.M. slight vomiting again occurred. Nothing but ice had been taken. Vomiting occurred at intervals during the next two hours, then ceased for one hour, and again recurred. At 12.15 A.M. the patient suddenly died.

Post-mortem examination (sixteen hours after death). Abdomen alone examined. This was greatly distended. Two more of the wire sutures had parted, as the consequence of the post-mortem gaseous distention of the abdomen. No adhesion of the parietal peritoneum at wound; about half a pint of dark sero-sanguinolent fluid in cavity; patches of lymphy exudation upon serous surface of intestines and parietal peritoneum; intestines generally hyperæmic; all of the intestinal wounds that had been sutured were closed, and at some points the convolutions of the gut were slightly adherent to the parietal peritoneum; all of the sutures were buried by the exudation, showing that good repair had begun; no fecal extravasation; a portion of the rent in the mesentery was gaping; a circumscribed abscess was discovered in the meso-colon, to the right of the vertebral column, and out of the line of direction of the bullet—this, said my medical friend who conducted the autopsy, "looked like the breaking down of a caseous lymphatic gland." The bullet was found in the soft parts behind the body of the fourth lumbar vertebra, on the left side, it having in its passage cut away a portion of the body of the vertebra; kidneys congested and ecchymotic.

REMARKS.—The present attitude of laparotomy for traumatism is such that it should be regarded as imperative with the profession to report every case occurring in practice. The very limited number of cases of operation for bullet wounds of the abdomen, without protrusion of the viscera, that have been reported, are not sufficient to furnish valuable statistical evidence. Nor is the contrast between the results obtained by the active and the passive treatment in such cases yet sufficient to elicit a unanimous verdict from experienced clinicians.

The case whose clinical history I have just read, is the third in which I have practised free abdominal section for bullet wounds of the abdomen without visceral protrusion. The time between my first and third operation is about twenty-three years. This long interval between these operations is explicable simply from the fact that cases where such practice could be instituted have rarely occurred to me. Upon two occasions, since my first operation, I have seen patients recover without interference. In one of these, the lapse of time before the case was seen rendered interference inadvisable; in the other, operation was rejected by the sufferer and his friends.

The limited number of laparotomies for wounds of this kind, done in the civilized world during the past twenty-three years, my operation of 1863 being regarded as the first, would lead to the inference that the procedure has not during this time been accepted by a large number of the surgeons of the world. This may be regarded either as an evidence of conservatism, or as a rejection of bold and venturesome effort because of its apparent inhumanity.

Upon the publication, in 1882, of my second case, a fatal one, I used these words:

"While this adds another fatal case to the short list of those in which similar treatment has been instituted, it does not alter my belief in the correctness of the practice in the class of injuries presenting so gloomy a prognosis."

Again, I said:

"While not as hopeful as my distinguished friend Dr. Sims, because of the success of ovariotomy, I do look forward to better results than have been so far obtained." "Listerism, and much of the knowledge acquired by the ovariotomist," I suggested, "would soon embolden surgeons who had heretofore favored the passive policy, and give us fuller statistics upon which to reach conclusions."

This opinion has begun to be verified, but the progress, if I can call it such, has been slower than a sanguine surgeon could have expected. Dr. Thomas S. K. Morton, in a valuable paper

(*The Medical News*, Feb. 19, 1887) entitled "Abdominal Section for Traumatism," read before the Philadelphia County Medical Society, on January 26, 1887 (and which paper anticipated much that I had purposed saying upon this occasion), gives, as he says, the result afforded by canvassing the literature of the world, and furnishing an abstract of every case which he had been able to find. The total number of cases of abdominal section for traumatism, as given is only 57. But 22 of these were cases of gunshot wounds. Of the 57 cases, 36 died, and 21 recovered, a mortality of 63 per cent. Of the 22 gunshot cases, 5 recovered and 17 died, a mortality of 77 per cent.

The gunshot cases alone concern us at present, but I trust I may be excused for alluding to one matter which personally interests me.

"The first case of abdominal section for traumatism," says Dr. Morton, "was that of Dr. Walters, of Pittsburg, for ruptured bladder, in 1862. The first successful case was the same. The first after Walters was that of Heath, in 1876. The first recovery after Walters's case was that of Dr. W. O. Robert, done for stab-wound, August 28, 1882.

"By the term abdominal section for traumatism is meant to include those cases where the operator deliberately opens the belly or greatly enlarges an existant wound for the purpose of discovering intraperitoneal wounds, and, if they are present, repairing them as far as possible, together with more or less final cleansing of the peritoneal cavity."

My first operation was performed May 27, 1863. This was for traumatism most certainly; and to say nothing of its being for gunshot injury, it should stand next to Walters's case, and before Heath's of 1867. My case recovered; so, in this regard too, the case precedes Roberts's of 1882. It most assuredly comes within Dr. Morton's definition of traumatism.

In this operation for gunshot wound, I deliberately opened the belly, repaired intraperitoneal wounds, and cleansed the peritoneal cavity. Again, Dr. Morton alludes to my case of 1881 as "the first recorded one of gunshot wound treated by abdominal section." "The first recovery of gunshot case," he

says, "was the case of Kocher, of Switzerland, in 1883." And afterward he says: "The first recovery was a case operated on by Dr. William T. Bull, of New York, in 1884." Dr. Morton intended, no doubt, to say that Dr. Bull's case was the first recovery in this country. In this he is correct, if my first operation of 1863 is to be excluded from the category of laparotomies for gunshot wound of the abdomen, and my case of 1881 recognized as the first case on record. This question I will leave for others to decide, it concerns me only so far as it pertains to the history of the operation. It is true that the operation of 1863 was practised seven months after reception of the wound. Nutrition of my patient was failing rapidly; there had been but one discharge per rectum, and that only the contents of the lower bowel, since the reception of the wound, and inevitable death was in the near future. Now it was that *laparotomy for gunshot wound, without protrusion of viscera, was done for the first time.*

In my publication of the case I urged this practice as applicable to recent gunshot wounds of the abdomen without protrusion. I put forward the success obtained as an argument against the almost universal practice of abandoning intestinal lesions of this kind to nature, rather than to risk opening boldly the peritoneal cavity. I expressed the opinion that the result of the operation should serve to encourage that hopefulness and boldness so essential to progressive surgery, and at all times preferable to despair.

Since the publication of Dr. Morton's statistics there have been several additional reports of operations to be added to the list. The cases of Dr. Packard, of Philadelphia, and Dr. C. Kollock, of Cheraw, S. C., now occur to me. The latter was a successful operation, and one worthy of notice, because of the confidence exhibited by the surgeon in his art, and the recovery of the patient under most adverse surroundings. The operation was done in a negro cabin, without professional assistance, and without the opportunity of carrying out antiseptic precautions.

The signs of our times, I now may be permitted to say, are most hopeful. Surgeons are beginning to accept the argument

of Baudens, long ago so boldly and happily expressed. No longer, I trust, will the fear of being regarded inhuman or too bold, "stay the hand that alone can preserve the days of a dying man." Humanity is not to be illustrated by inactivity or stoical indifference. The rule of conduct, as said Baudens, should rather be the well-known aphorism, "*Nullius anceps remedium æquam nullam.*"

There are several points of special interest connected with the clinical history of this case, to which I will briefly advert. First. The absence of symptoms thought to be of diagnostic value in intestinal lesions from bullet wounds. There was no marked shock, no escape of fecal matter from the abdominal wound, no sudden meteorism. To have relied upon this negative evidence, and to have resorted to a passive treatment under the assumption that there was no intestinal lesion, would, it is true, have been of no detriment to this patient, as the result proved, yet I would have been led far away from a correct diagnosis.

Second. From the numerous intestinal perforations there was no escape of fecal matter into the peritoneal cavity. I have upon another occasion called attention to this fact as one not to be passed over in connection with our reasoning as to the propriety of an active or passive treatment in gunshot wounds of the abdomen. (*Journal of American Medical Association*, Dec. 18, 1886.) It is certainly an argument to be used against the active treatment. The prevailing idea is that general peritonitis arises from fecal extravasations, and that the indication for laparotomy is mainly founded upon the necessity of obviating or removing this supposed cause. To quote merely from two high American authorities: says Gross, in his *System of Surgery*,

"The great danger is from fecal effusion, and such effusion is almost inevitable, even when the opening of the intestine is of very small extent.

Says Hamilton, in his *Treatise on Military Surgery and Hygiene*,

"It is equally true that death, in a great majority of cases, is caused

by extravasation of the contents of the bowels into the peritoneal cavity, and the consequent inflammation."

It is, indeed, difficult to explain the absence of fecal extravasation in the more fearful intestinal lesions, however easy it may be to understand this in cases of very slight wounds. I desire only to offer my clinical experience in corroboration of what has been observed by others. The spasmodic rigidity and hardness of portions of intestines injured have been noted by Baudens, and suggested as a diagnostic sign to be recollected when the finger is to be passed through the parietal wound into the peritoneal cavity. I particularly observed, in my investigation, that the intestinal perforations were measurably closed by the crowding of the mucous and muscular coats of the bowel into the wounds of the peritoneal layer, these tissues seeming to act like a cork in preventing the escape of the fluid contents. Paralysis of the tube, the result of the severe shock and injury, may, by preventing peristaltic action, explain to some extent the absence of fecal exudation. Gross, in his *Experimental and Critical Inquiry into the Nature and Treatment of the Wounds of the Intestines*, tells us of the marked contraction and eversion of incised wounds of the intestines, by which the extent of the wound becomes much reduced. The experiments of Mr. Travers to prove that fecal extravasation was not a necessary consequence of punctured and incised wounds of the intestines are familiar to all. Mr. Erichsen, among the most prominent of modern surgeons, has affirmed that "it is seldom that feces are extravasated from a gut that is not protruding, unless it be very full at the time of injury, or the wound in it be very large." He cites two cases of shot wounds of the intestine, coming within his own observation, to bear him out in this assertion. There are also others who have entertained similar views. In the *Surgical History of the War of the Rebellion*, Dr. Otis notices these recorded observations, and, in his enthusiasm for *his* side of the argument, pronounces them "dangerous fallacies." The truth most probably is that the cases in which there is no fecal extravasation constitute exceptions to the general rule. In any

investigations of scientific truth it is well for one to present fairly the arguments which seem to militate against his own view of the case, and it is with this idea that I have called attention to the above facts.

Third. I have in both of my fatal cases been impressed with the little suffering experienced by the wounded, and their almost painless death. This is contrary to general observation and belief in cases of acute general peritonitis. As a rule, death comes quickly. With "hyper-acute peritonitis," says Baudens, "life is prolonged scarcely more than twenty-four hours." But, in the language of John Bell, death is not easy: "there soon come on dreadful pain and vomiting, costiveness, hiccough, the torments of the *miserere mei*, and the patient in great anguish expires." Where gangrene results there may be a "deceitful ease," a slower and less painful death. How is this absence of suffering to be explained? It is probable that the use of the drainage tube, admitting of the escape of the inflammatory effusion, and thus relieving belly tension, may have something to do with it.

The treatment of acute peritonitis by abdominal section has been proposed and practised. Should relief from pain follow upon such practice, it may be explicable upon the same principle. This may be advanced as another argument for laparotomy in intestinal wounds, for next to the cure of disease we look to the satisfaction coming of a painless death—the humanity of a bold practice.

Fourth. The fatal termination of a case like the one I have reported should not be used as an argument against the treatment by laparotomy. Abdominal wounds, the precise nature and extent of which can scarcely be revealed before operation, must often prove as fatal as are cases of brain and heart injuries which are at once fully recognized. Prognosis must at times not be announced until suggested by diagnosis. This case is one in point. The injury to the mesentery, apart from the numerous intestinal perforations, was, perhaps, sufficient to insure a fatal result, by its consequent peritonitis and sepsis. The surroundings of the case were unfavorable to operation, as all

will admit who know anything of a negro hospital in a southern latitude. The rupture of one of the wire sutures, and the consequent hernial protrusion, was most unfortunate. I cannot pretend to say how far these accidents may have influenced the destructive processes which eventuated in death. At the time of the operation I objected to the character of the wire handed me for use, fearing that it had not the necessary strength It happened to be all that was in the hospital at the time, and had to be accepted. The tension of the abdominal walls in the powerfully muscular subject delayed the operative procedure, and was a formidable obstacle to the return of the intestines into the cavity, and the keeping of them there. To some extent this tension was increased, as inflammatory results appeared, and thus the strain upon the sutures was more than they could bear.

The formation of a circumscribed abscess in the meso-colon in so short a period of time I allude to, in conclusion, as a striking feature in the pathology of the case.

PISTOL-SHOT WOUND OF THE ABDOMEN,

Involving the Liver, Stomach, Superior Mesenteric Artery and Vein, Small Intestine, and Kidney: Laparotomy; Nephrectomy; Death on the Fifteenth Day; Autopsy.

By W. W. KEEN, M.D.,

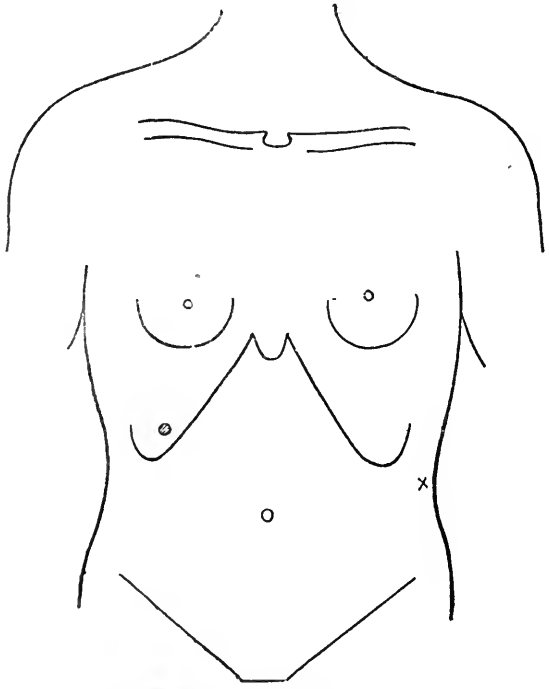
PROFESSOR OF SURGERY IN THE WOMAN'S MEDICAL COLLEGE OF PENNA., SURGEON TO ST. MARY'S HOSPITAL, ETC.

Miss B., in Vineland, N. J., a plump and healthy well-developed girl of nearly eighteen, shot herself with a pistol, calibre No. 32, at 6.30 A.M., April 1, 1887. In a few minutes she was found by the family, who had been roused by the shot, lying on the floor of the room next her bedroom, bleeding slightly, and conscious, and was carried to her bed. Dr. O. H. Adams, who arrived in a few minutes, found that the ball had entered over the liver, and after a careful search found it lying under the skin of the left flank. She was pale and weak and suffering considerable pain. Giving her one-quarter of a grain of morphia subcutaneously and directing that no food be given her, he telegraphed for me. I reached there at 2 P. M.

She was perfectly conscious, very pallid and weak, suffering moderately. Her night dress was blackened and burned over a space four to five inches in diameter. She told me that the wound was self-inflicted, hence the pistol had been almost in contact with the body, and the ball had probably passed in a straight line. The small, blackened wound of entrance was seen over the ninth rib, which was fractured, four and a half inches above the level of the navel, and three and three quarters inches to the right of the median line. Skin not burned. The ball was located eight inches to the left of the median line, one and a half inches above the level of the navel. There was moderate tenderness over the entire belly, hepatic dulness not

changed, stomach resonant from fifth interspace, no cough, no râles, vocal fremitus normal, renal dulness began at tenth rib on left side, and was the same on the two sides. There was severe pain in the left shoulder. She had vomited a drachm and a half of clear, bright blood, she told me, immediately after the accident. This had been lost, but

FIG. 1.

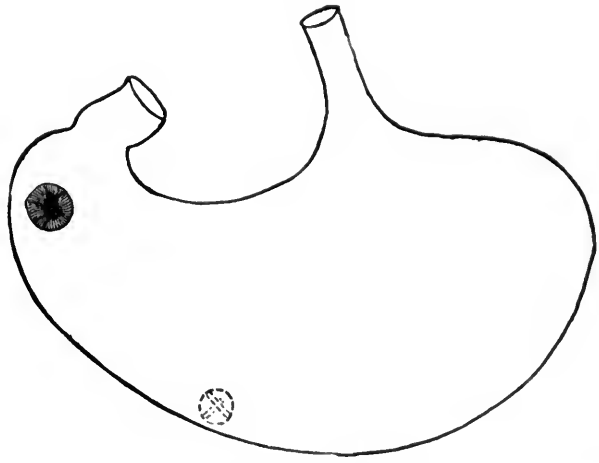


● Wound of entrance.
x Point of lodgement of ball.

I saw what she had twice vomited later. It was ordinary mucous and bilious vomiting, streaked with a few drops of blood. About a pint of urine, the first since the accident, was drawn by the catheter. It was not bloody. Pulse 104, respiration 30. No material rise of temperature. As after consultation with Drs. Adams and Bidwell it was deemed almost certain that the belly was invaded by the ball, exploratory laparotomy was advised, consented to, begun at 3 P. M., and terminated at 6 P. M.

Operation. The instruments were in 5 per cent. solution carbolic acid, the sponges had been lying in a similar solution for five days; hands and nails were cleaned by soap and water and corrosive sublimate 1:1000; the wall of the abdomen was thoroughly washed with the sublimate solution, especially at the wound of entrance and the navel, an easy hiding-place for dirt and mischief. Plenty of towels in a warm sublimate solution were provided. The sponges were placed in the sublimate solution during the operation. Ether given by Dr. Beck. The ball was easily removed just under the skin. Neither wound could be traced positively into the belly. An incision was then made in the median line from the epigastrium downward three

FIG. 2.



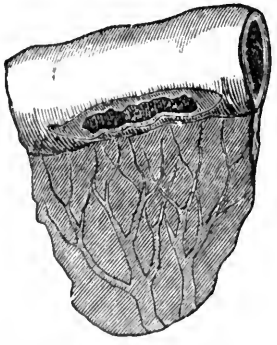
WOUNDS OF STOMACH.

THE WOUND OF EXIT IS DOTTED, AS IT DID NOT SHOW IN THIS VIEW OF THE STOMACH, BEING ON THE INFERIOR AND POSTERIOR SURFACE.

inches long, subsequently prolonged to eight inches, and in such a position that it crossed a line joining the two wounds, so that, if the ball had passed in the belly wall only, its track would be found. On opening the belly neither blood nor serum escaped, nor was any extravasated food or feces noticed. There was no peritonitis. Two fingers were passed in and an effort made to discover the wound of entrance or exit without any being revealed by touch. The wound was then enlarged and the stomach drawn out. A small round wound near the pylorus was found and was closed by four sutures (Lembert)

of the finest iron-dyed silk a round ordinary sewing needle being used, only the peritoneum and muscular coat being caught by the sutures. This wound was practically closed by the pouting mucous membrane. As the ball had entered the stomach, search was made for the necessary wound of exit. None was to be found, but the manipulation showed that a small amount of bloody serum existed in the belly, and a large area of extravasation was seen in the mesentery. The cause for this bleeding was then sought. The bowels were carefully drawn out and placed on the belly wall wrapped in towels kept wet with the warm sublimate solution. The blood extended fan-shaped in a moderately thick layer between the two layers of the mesentery, its periphery extending almost two feet along the bowel and its point or apex being at the mesenteric attachment to the spine just below the head of the pancreas and in the line of the wound. But little blood had escaped into the peritoneal cavity. The mesentery was carefully torn through and a small artery tied. The chief bleeding came from a hole nearly one-eighth inch in diameter in a large vein, so large and lax that at first I thought it the vena cava, but its position just below the head of the pancreas convinced me that it was the large superior mesenteric vein just before it forms the portal vein. After much difficulty I seized it with hemostatic forceps and placed a lateral ligature of chromicized catgut on it.

FIG. 3.



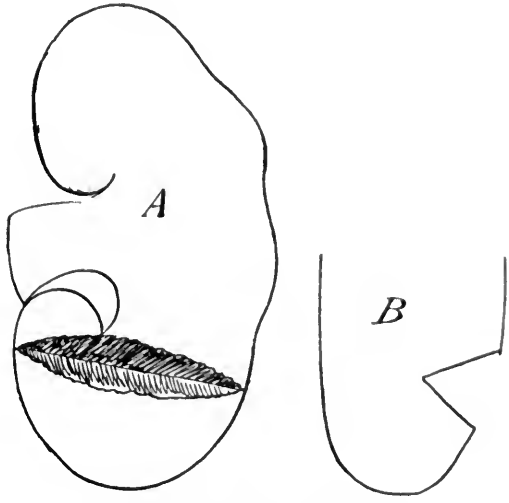
PERFORATING WOUND OF THE SMALL INTESTINE 1¼ X ½ INCH, LACERATION OF PERITONEUM BEYOND THE WOUND, POUTING OF THE MUCOUS MEMBRANE.

Meantime the manipulation had revealed a moderate bleeding point in the omentum near the wound of entrance. This was tied with catgut, and the ligatured part cut off. The anterior border of the liver

had been scalloped by the ball, but as there was no bleeding it was let alone. In addition, a large wound in a coil of small intestine in the left flank had been found. This was one and a quarter inches by half an inch, the long axis in the axis of the bowel, almost at the mesenteric attachment, its edges ragged, the mucous membrane pouting into the wound, but not closing it, the peritoneal wound extending beyond that of the muscular coat. No bleeding was going on. The bowel and mesentery here were carefully examined on both sides, and upward and downward, to find any other wound, but neither did the bowel nor the mesentery show the slightest lesion. A little bilious matter escaped during the closure. This was quickly caught on a sponge and the bowel carefully cleansed. Ten Lembert sutures were used in closing it.

Returning now to the stomach, a very careful search was again made for the wound of exit. Two small patches apparently of extravasation had been seen before, in the lower border, about four inches from the pylorus, and it was now found that one of these, instead of being

FIG. 4.



A Shows the wound in the kidney.
B Shows its depth.

an extravasation, was the small, round wound of exit, obscured by a slight coating of blood. This was closed by three black silk Lembert sutures, as in the case of the other wound.

Thus far, one lesion after another had been attended to as found, and in the order of urgency. A systematic investigation was now made of the entire bowel, from the stomach to the sigmoid flexure, but no other wound was discovered. Each coil as it was drawn out was examined first on one side and then on the other. The wound of exit from the peritoneal cavity next received attention, while the bowels were lying outside the belly wall. It could now be found after a moderately easy search. I passed my finger in, and discovered that the left kidney was badly lacerated, and I immediately removed it, peeling it out of its capsule, and tying the pedicle with a stout silk ligature. No difficulty attended this step. On removal, the kidney was found to be ploughed through by the ball, on its anterior surface, from the hilum to the opposite border half way through its entire thickness one-third of its length above the lower end. Very little blood, and, so far as I could determine, no urine, was found at the site of the kidney. A rubber drainage tube was inserted through the wound of exit into the abdominal cavity.

Her condition by this time was such that no time was to be lost in completing the operation. The abdomen was therefore washed out by a hot sublimate solution (110° to 115°) till the water flowed out clear; the amount of blood so washed out being but little, some of which had passed into Douglas's cul-de-sac. The bowels were replaced, the omentum carefully spread out over them, and the abdomen closed. This was done by nine deep silver-wire stitches, including the peritoneum, and eight intervening ones of silk. I should have sutured the peritoneum at the site of the removed kidney, and also have sutured it in front independently of the rest of the abdominal wall, but that the condition of the patient was such as to forbid the necessary delay. As a matter of fact, no added risk was caused. The wound of entrance was then cleansed, and closed by three stitches, and the wound of exit was closed by two stitches, except where the drainage tube passed out. Am Ende's sublimate gauze, rubber dam, and a wide flannel bandage completed the dressing, and she was then placed in bed with hot bottles and blankets. Pulse 175, and very weak. Some hypodermic injections of whiskey had been given with advantage during the operation.

During the night a little cracked ice and some ice water and half a grain of morphia were given. She had had considerable pain, but had slept about three hours. At 9.30 P.M. ℥ij clear urine had been drawn, but from then till 7 A.M. only ℥ss was secreted. The morning tem-

perature was only 99.4°; pulse 146, and respiration 18. At the request of her mother, who had meantime arrived from New York, I asked my friend, Dr. Weir, of New York, to see her. He arrived the next day, in my absence of course, and coincided in the wisdom of the course taken, especially as to the kidney.

Drs. Adams and Bidwell took charge of the case until I was able to see her again with them on April 5th. From their daily reports I condense her history as follows:

During the day following the operation suppression of urine was threatened, only ʒiijss being secreted. This was quite albuminous. The next day, however, the amount rose to ʒxxiv, and on the third day to ʒxl, and the albumen gradually disappeared. Her temperature fluctuated between 100° and 101°, rising once to 102.5°, when a sponge bath and for a short time an ice bag to the abdomen brought it down to 101°. For the first three days, as she was so fat and hearty, nothing was given her except a little cracked ice, ice water, and a little whiskey and champagne. On the fourth day peptonized milk in frequent but small quantities was allowed with rectal enemata of the same every four to six hours, and later of "liquid peptonoids," "beef peptonoids," and "bovinine." The rectal alimentation was prevented earlier by reason of a number of watery, but not bloody stools. She had also vomited several times, once on April 4th quite violently. The matter vomited was bilious, with no blood in it. She had been in a great deal of pain, which was fairly controlled by morphia. For a short time on the fourth also she was delirious. Menstruation appeared regularly, when due, on April 3d, and ran its usual course of four days.

At my visit on the 5th of April I found her, on the whole, doing well. Her temperature had that morning fallen to the normal, pulse 114, respiration 16, but I did not like her anxious expression and continuous pain and sleeplessness. She was thirsty, but not hungry. On changing the dressings I found the wound of entrance healed. From the wound of exit, which Dr. Adams had dressed on the 4th, there was scarcely any discharge. It was healed except for the drainage tube. The abdominal wound was firmly healed at the upper and lower ends. The third, fourth, and fifth deep wire stitches had broken, presumably when the violent vomiting took place the day before or possibly earlier. The intervening silk stitches prevented much gaping. Where the gaping took place the omentum was somewhat exposed, but as it and the belly walls were well glued together, I did not disturb them save to introduce one stitch of support at the widest gap, but I did not approximate

the edges, as there was a drop or two of discharge from small aseptic stitch abscesses, and I feared lest I might force it into the abdominal cavity.

At my next visit, April 7th, I found the wounds doing well, no further gaping. Six stitches at the two ends were removed, as also the drainage tube, from which there had been no discharge. The pain in the left shoulder and at the epigastrium continued to a moderate extent. There was no peritonitis or tympany. But her temperature had risen to 101.3°, and the pulse to 124.

On the 8th, at noon, she had a chill lasting twelve minutes. The temperature rose to 104°, the pulse to 148, and the respiration to 32; the temperature, however, falling to 99° by 6 P. M. Her stomach and bowels had also become irritable, and much of her nourishment was lost. I did not receive the telegram calling me there till after the last train had left, so that I did not see her till the 9th. She had had another chill that morning, and her condition was most critical; temperature 104°, pulse 160, and very weak, respiration 36 and shallow. I suspected, of course, pus at some point, and debated reopening the belly, but as the most careful examination revealed no spot of special tenderness, no dulness, no fluctuation, and she was almost, it seemed, *in articulo mortis*, I did not deem it prudent to do so, lest she should die at once.

The next day, the 10th, she improved somewhat, her temperature falling to 99° and 101.5°. She had a natural movement from the bowels, with neither blood nor pus. She still vomited considerably.

April 11. Dr. Weir saw her with me. Her temp. was 100.6°; pulse 120; resp. 24. The most careful examination showed nothing locally that would guide us in reopening the belly, either in front or flank, especially in her then bettering condition. There was no pain, except on very deep pressure, which produced diffused pain; nothing in Douglas's cul-de-sac; uterus movable, not tender; no peritonitis anywhere; only the stitch wounds were tender with slight suppuration about them, and on the surface of the exposed omentum. We thought it not impossible that the chills, etc., arose from those stitch wounds, and almost hoped she would still pull through. The wound was washed and redressed as before, rubber adhesive plaster supporting the belly wall outside the dressing.

13th. I saw her again. She had had another chill, with a temperature of 105 4°, and had vomited several times, and also had some involuntary evacuations. But as her condition was fair, pulse 136,

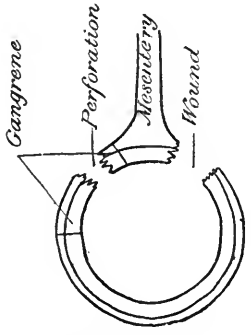
temp. 101.4°, I decided to reopen the belly, and explore it. No dulness, hardness, tenderness, or œdema existed to determine any opinion as to suppuration, but I feared a possible mesenteric abscess. No ether was given, and very little pain was felt. The adhesions between the omentum and the belly-wall were broken up with very moderate force, and two fingers passed into the belly. The intestines were bright and glistening, and no peritonitis existed anywhere. Surgical bimanual examination revealed no pus or special tenderness at the site of the removed kidney, or so far as it could be located at the intestinal wound. The stomach and liver were in good condition. The fingers detected a general hard mass at the site of the wounded superior mesenteric artery and vein, but there was no fluctuation, and when withdrawn the fingers showed no pus, nor did a sponge passed into the same point show any. The wound was then reclosed by sutures, care being taken to replace the omentum and belly-walls in as nearly their former position as possible, and a glass drain inserted as a precaution. No shock followed. Her temperature fell temporarily during the evening, though it rose again during the night, and she slept nearly three hours.

During the next day (April 14) she had two bloody movements; she began to have involuntary discharges of urine as well as feces, and though her temperature never rose beyond 102.2°, she gradually failed, and died April 15th, at 1.30 P.M.

The autopsy was made by the Coroner's direction, by Dr. H. C. Smith, of Millville, twenty-one hours after death. Through his courtesy, as well as from Drs. Adams and Bidwell (for I was unable to be present), I obtained the following facts, as well as the stomach, bowel, and right kidney. There was general peritonitis, except in the pelvis, but no free pus was found anywhere. The wound in the liver was healed. Only one wound was found in the stomach near the pylorus, and this was healed, the four stitches being seen in place. The site of the other could not be found, nor could its three stitches be found anywhere. Search was made in the duodenum also, but no wound could be discovered. The duodenum, head of the pancreas, and mesentery were softened and matted together by inflammatory exudate, and the head of the pancreas was cheesy. The blood in the mesentery was disintegrating and suppurating, though no abscess existed, nor was there any free pus in the peritoneal cavity. The suppuration was chiefly marked along the mesenteric attachment of the intestine. The wound in the small intestine was found entirely healed, the stitches being in place, and covered with a thin layer of lymph.

On the other side of the mesentery, corresponding in position to the lower end of this wound, was a spot in the bowel-wall as large as a five cent coin, which was gangrenous, and in its centre was a double perforation of bowel with pus in the calibre of the bowel. I did not

FIG. 5.



SECTION OF WOUND IN SMALL INTESTINE AT *a* IN FIG. 3, SHOWING THE SIZE OF THE GANGRENOUS SPOT AND PERFORATIONS FOUND AT THE POST-MORTEM. THE WOUND IS REPRESENTED OPEN, AS AT THE OPERATION.

receive the mesentery, but I am told that it also showed local gangrene at this place. Very careful and systematic search of the entire length of the bowel revealed no wound, except that discovered at the operation. No trouble was found at the site of the removed kidney. The right kidney was removed, and found healthy and enlarged. Both kidneys having been in the same bottle in alcohol, the right for two weeks, the left for four, their measurements are: right, 4¼ by 2⅜ inches; left, 3½ by 1⅝ inches; the right kidney is also thicker. The spleen was normal; right ovary cystic. Only the abdomen was examined.

REMARKS.—The question of doing a laparotomy was not wholly easy to decide. Besides, social circumstances, which made me hesitate to assume any except urgent responsibility, neither wound could be positively traced into the belly cavity, though the nearness of the pistol made it almost certain that the ball had pursued a straight line, and if so, had penetrated the abdomen. It is worthy of note, in this connection, that when the fingers were in the abdominal cavity the wound of entrance

could not be felt, and later, when, by lifting the belly wall, the perforation in the peritoneum could be *seen*, when the finger was placed there it still could not be *felt*. The amount of clear blood vomited at the time of the accident was very small, and we had only the statement of the wounded girl to depend upon. Even this, as well as the streaking of blood in the later vomited matters, could come from contusion or her fall. There was no evidence of blood either by the bowel or the bladder. Her long continued and deep pallor, weak and rapid pulse pointed toward hemorrhage, but palpation and percussion did not give positive evidence of any. But, as everything seemed to point toward the *probability* of the belly's being penetrated, I determined upon an exploratory laparotomy, in order to determine the facts *absolutely*. In this decision my colleagues coincided. Fortunately, the presumed course of the ball crossed the proper line of incision, and I was able to decide that it had not traversed the wall of the belly by not finding its path while I was making my first incision, and before opening the peritoneum.

No food having been taken before the early hour in the morning at which the shooting occurred fortunately prevented any extravasation of food, and none of the wounds being in the lower bowel, no feces escaped. Although it was nearly ten hours from the accident to the time when the intestine and stomach were sutured, it is worthy of notice that no intestinal or gastric juice or fluid contents escaped, even though the intestinal wound was so large and gaping, and vomiting occurred three times prior to the laparotomy. The pouting mucous membrane well occluded the gastric wounds, but not the intestinal.

The second opening in the stomach was difficult to find, and was at first mistaken for a simple extravasation, a fact already noted by Dr. Briddon[1] as occurring in a case of his own. There was, however, no doubt as to its existence, and I put three sutures in its edges At the post-mortem no evidence of its position could be found, though careful search was made both in the stomach and the duodenum, the possibility that I might

[1] The Medical News, January 8, 1887.

have measured the wrong way being borne in mind. There is neither scar nor sutures to be found on the outer or inner surface of the stomach. The sutures in the other stomach wound are in place, and look as though they would remain for some time. Whether, in the other wound, the sutures disappeared internally after the healing of the small wound, or loosened and were lost in the belly cavity, cannot be determined.

The peritonitis found at the autopsy did not exist on the twelfth day, when the belly was reëxplored. Nowhere was the glistening peritoneum then dulled. Two sources existed for the later peritonitis—the opening in the intestinal wall opposite the intestinal wound and the mesenteric pus. The former was the most likely source. At the operation the bowel and mesentery were carefully inspected on both sides, but no such opening existed. Had it been made by the ball, peritonitis would undoubtedly have occurred quickly after the operation, and there would not have been *two* openings here, as the specimen shows. I have no doubt that the fact was that the ball contused a part of the mesentery, especially probably an arterial branch. This did not show at the time, but later on produced a limited gangrene, and perforation took place a day or two before death. Dr. Smith, also, tells me that the mesentery itself was necrosed at this place. The bloody stools preceding death point in the same direction, especially as she had had a natural movement of the bowels, with neither blood nor pus, on the ninth day after the wounding. Hereafter however, in all cases of intestinal gunshot wound, whether single or double, I shall examine the mesentery more minutely for any possible evidence of contusion as well as perforation.

Possibly this necrotic process in the bowel, as well as the general softening of the duodenum, was promoted by the serious wound of the superior mesenteric vessels, especially the vein. The artery was a small branch, but the vein was the main trunk just below the head of the pancreas, and so large that when I first seized the bleeding point and lifted the wall I thought it the vena cava. I placed a lateral ligature upon it, seizing the margin of the small opening, as large as the lead of a pencil,

and securing it by a catgut ligature. To dissect the vein loose and encircle it with the ligature would have required a considerable loss of time, which I wished to avoid, and besides, I feared the effect on the bowel of obstructing so large a vein. Whether a thrombus formed in the vessel, and occluded it, was not examined at the autopsy. The blood, curiously enough, did not find vent into the peritoneal cavity by the wounds in the mesentery, save to a very slight extent, but dissected the two layers of the mesentery, and was spread out, fan-like, from its source to two feet of bowel, in a moderately thick layer, thickest at the spine. This it was impossible to remove, and I had to trust to its absorption. I was not surprised that there was trouble at the site of this wound in view of the injury done by the ball, and the necessary manipulation to get at and secure the vessels. It is worthy of note, however, that the chief trouble existed at the periphery of the clot near the bowel, where we would expect absorption most readily to take place. Probably the main absorbent trunks from this part, as they approached the spine, may have been obstructed by pressure, or have been injured by the ball or during the operation.

The kidney, I believe, has never before been removed at a laparotomy for gunshot wound, but it was clearly the right thing to do. Bloody urine is one of the most frequent signs in injuries of the kidney, and its absence here was remarkable. The wound extended entirely across the kidney, and half way through its thickness, yet the urine (℥xvj) drawn eight hours after the accident (and none had been passed) was absolutely free from blood, the injury apparently arresting the function of this kidney, while the laceration of the renal substance was such that but slight bleeding occurred. Possibly the urine drawn had been mostly secreted during the night. The day following the operation the remaining kidney worked badly, only three and a half ounces of albuminous urine being secreted. But the next two days dispelled all anxiety on this score, the urine rising to twenty-four and forty ounces respectively, and the albumen soon disappeared. The early and marked compensatory enlargement of the right kidney is also of great interest

and importance, though, of course, now well known to follow nephrectomy.

When the chills occurred, due, no doubt, to the necrosis and suppuration of the large mesenteric blood clot, naturally the first impulse would be to open the belly, anteriorly or in the flank, and search for the pus. But I was deterred from this course by her general condition, which then threatened almost immediate dissolution, and by the fact that no peritonitis existed at the spots most likely to be the seats of suppuration. The most careful external examination revealed its absence. To this, possibly, the wounded vessels and effused blood should be an exception. Even here, however, there was no dulness, fluctuation, or hardness, and the slight tenderness that existed was to be expected. When I did reopen the belly and examine this spot I found only a general matting of the tissues, and no accumulation of pus in an abscess. What pus did exist at the post-mortem was not free in the belly, nor accumulated in an abscess, but diffused between the mesenteric layers.

I did not suture the peritoneum at the site of the removed kidney, as the patient's condition did not allow of the delay, and no harm came of it. In view of the possibility of the giving way of stitches in the abdominal wound, which occurred here, and also in a case of Dr. Bull's (and exposed the intestines), I should hereafter take time to close the peritoneum by a continuous catgut suture before suturing the abdominal wall, even if the patient's condition were bad. The avoidance of possible subsequent dangers would justify taking a certain amount of present risk.

The reason for the severe and quite persistent pain in the left shoulder, I could not determine.

DISCUSSION.

DR. P. S. CONNER, of Cincinnati, Ohio.

I have been exceedingly interested in the papers read to-day. The subject is one of great interest, probably the most interesting surgical subject that could have been brought before us at the present time. The papers have had reference to diagnosis, the results of experimental investigations, theoretical considerations, the proper method of procedure, the different contraindications, and the results; and further than that, we have had these points reinforced by clinical reports.

As respects the operative procedures themselves, there is little to be said. We are all agreed that where an operation must be made, it should be performed in a certain definite way, as indicated. The most important point is, however, not how to close up a wound in the intestine, but to know when to open the abdominal cavity in order to find the wound, if such exists. The question of diagnosis is by far the most important one. We know perfectly well that in the great majority of perforating wounds of the intestinal cavity, death results, either from shock, or from hemorrhage, or from extravasation—peritonitis. We know, further, that a limited proportion of these cases will recover if let alone. We also know that, if the operation is made, it by no means necessarily saves the patient. My own experience has been that, in the presence of the actual case, the important point to be determined is, whether or not it is advisable to add to the existing traumatism another by opening the abdomen. If there is extravasation of the contents of the viscera, feces, urine, or bile, there is no doubt as to the character of the injury, but, if there is no such extravasation, if we simply recognize the fact that a stab wound, or a gunshot wound has involved the wall of the abdomen, it is a very serious question to decide whether any visceral lesion has occurred or not. There is no single symptom that I know of that can be relied on. There may be vomiting of blood, and it will not necessarily indicate perforation. It may result from contusion. The ball may have passed through the stomach itself, or, still more, through some portion of the bowel, and there may be no vomiting of blood. Hemorrhage from the rectum does not mean anything. There may be free voiding of blood in consequence of contusion. On the other hand, the ball may have passed through the bowel, and no blood be poured out.

Shock does not indicate anything. We would suppose that an individual struck in the abdomen would have profound shock, and generally this is the case, but I have seen as profound shock after injury to the hand as after injury to the abdomen. A contusion of the abdominal wall may occasion intense shock. It may be thought that there is the condition of collapse due to hemorrhage, and yet subsequent investigation show that no blood has been lost, the condition being one simply of nervous shock. I have thought that a good deal of confidence was to be placed in Redard's observation, that profound depression of temperature, prolonged beyond the ordinary period, was indicative of peritoneal or visceral lesion. If the temperature is subnormal after the lapse of four or five, and still more after six hours, penetration or perforation may be assumed to exist almost as a moral certainty. Yet, not one or all of these symptoms proves that the intestinal tract has been opened or the solid viscera injured.

Shall we open the abdomen and see? Theoretically, yes; practically, perhaps so. We know that the chances are against the patient if penetration or perforation exists, and nothing is done; but, if we open the abdomen and find no injury, we certainly have not benefited the patient; on the contrary, I think that the patient has been positively injured. Diagnostitial laparotomy is all very well. It is admirable, under certain circumstances, but laparotomy upon that individual whose peritoneum has been perfectly healthy until within a few hours, is a different matter from operating on an individual whose abdominal cavity has contained a tumor for a considerable length of time. Another point: it is well to say that these cases should be operated on, and operated on early. It is well to do it, and it is practicable to do it, sometimes, in hospital cases. It is not so easy in private practice, however. The patient and his friends have something to say about the matter. The surgeon must, also, in a measure, consider the interests of others than the patient. Many of these cases necessarily involve legal investigation, and if it be shown that laparotomy has been performed, and that the patient would have done as well, or better, if the abdomen had not been opened, it may go a long ways toward clearing a guilty individual. If the laparotomy be followed by death, it may be an easy matter for lawyers to convince a jury that the death was consequent not upon the original injury, but upon the surgeon's knife.

If we do open the abdomen, and find wounds, and close them as we readily can do, it is probable that a large percentage of these cases

will recover if the operation is done early. If it is deferred eighteen, twenty-four or more hours, the chances of recovery, although the wounds be sealed never so well, are slight. The patient will die. I have myself seen a case in the hands of my colleague, Dr. Dandridge, in which I think eleven wounds of the intestine existed. These were accurately closed. The result was a complete prevention of the outpouring of any fluids from the intestinal canal. The patient died, however, not in consequence of the operation, and probably the issue was not affected by the operation. I have closed a stab-wound in which the intestines were perforated in two places and the omentum in one. The wounds were so closed that after death not a drop of water could be forced through, yet the patient died in twenty-four hours. A considerable proportion of these cases must necessarily die.

While I think that it is wise to lay down the general rule that penetrating wounds of the abdomen, and still more, perforating wounds of the viscera, should be followed by opening of the abdomen and closure of the wounds, at the same time it is to be remembered that such operation is one not absolutely safe and altogether devoid of danger to life; and we are not justified in laying down the hard and fast rule that this must be done, and, if not done, the cause of death is to be found as much in such sin of omission as in the injury itself.

We want light thrown upon the diagnosis of these cases. If, without opening the belly, it can be ascertained that penetration or perforation has or has not occurred, we want to know how. The ordinarily given diagnostic signs are exceedingly unreliable. They are treacherous; and while we are studying them and debating whether or not it is best to open the abdomen, precious moments are lost in which the operation might have saved the patient. Many patients will be lost in consequence of the delay which seems to be inevitable in the present state of our knowledge.

Dr. Moses Gunn, of Chicago.

I really do not know that I have much to say upon this subject. The remarks of Dr. Conner, pro and con, have certainly thrown a cloud upon the subject which I cannot penetrate. I have never been more interested in a set of papers than I have been in those read to-day. The paper of Dr. Warren was of such a nature as to require no discussion. The experiments were ingenious, well conducted, and only to be commended. So far as such experiments can throw light upon human surgery, they have done so. So far as they are

capable of illustrating the use of sutures and the different kinds of sutures, they have done so, and it is well. These experiments contribute to our fund of knowledge and have a practical bearing upon human surgery. When my friend from Philadelphia got up with his paper, which could not be abbreviated, and with his eye upon the clock, came down with a perfect *tourbillon* that swept the whole ground, diagnostitial and medico-legal, entering into the details of surgery and bringing up almost every possible contingency, and all within a short space of time, I must say that I was bewildered. The paper was admirable, but it was given too rapidly. It was too big a dose for the allotted time. I was unable to follow the paper in such a way as to be able to discuss it.

Then our friend from South Carolina comes with his interesting case, in which he details the chief points of two other cases which also throw their light upon the difficulties of the subject. Then Dr. Keen brings forward a case of extreme interest, but, after all, we must say that so far as the chief point is concerned, the point of diagnosis, it leaves the subject about as much in the dark as ever. I know that my friend from Philadelphia went over the ground, and as near as I could follow him, gave a pretty full detail of the circumstances on which the diagnosis should be based. I certainly cannot criticise it.

As Dr. Conner has said, the chief point is the diagnosis. As the papers were being read, and particularly as my enthusiastic friend from Philadelphia was reading his paper, my mind went back over the whole history of laparotomy and of laparotomy for ovarian tumor and kindred conditions. When these operations were first made, it was said that the operaaion was a lottery, with a strong probability of drawing a blank. As the success of the operation increased, it was said that such success depended perhaps upon the changes which had taken place in the peritoneum. The old idea was that you could touch no serous membrane, particularly the peritoneum, without exciting inflammation. Any injury or operation upon the peritoneum was to be avoided, as it was peculiarly susceptible to inflammation. When the ovariotomists brought forward their cases in which they had detached extensive adhesions and had closed up torn vessels and tissues, then the profession grasped the idea that the success was due to changes which had taken place in the peritoneum. The previous inflammation and adhesions were said to have altered its nature so that it was more like general connective tissue. The general idea was that ovariotomy should be postponed as long as possible, in order that these changes might take

place. As advances in aseptic surgery were made, a change came over the spirit of that dream, and it began to be ascertained that the time for operation was early. Laparotomies were not necessarily fatal, and the peritoneum in its pristine originality could be handled with impunity if proper aseptic precautions were observed. That rule obtains at the present time.

As I went over all this, I came to the time when the enthusiastic Sims, a few years ago, took the ground that he did with reference to traumatism of this cavity, and the profession at first stood back almost aghast. Laparotomy might be very nice in diseases of the abdomen, but in traumatism, he was a bold man who would undertake the operation. A few years pass and we find that we are doing such operations, and in many instances with success, and I think that we are all prepared to say that they should be made. In the majority of cases fatal results will come as a consequence of the injury if left without operative interference, and where there is probable perforation of the intestine or wounds of other viscera, I think that we are all prepared to say, that on the whole, a resort to laparotomy is a safe measure to pursue. The only question is how to make the diagnosis. In doing this we naturally look over the ground and see what cases have recovered without any interference. We can all call to mind cases in which there was apparently every sign of intestinal injury, and yet there has been rapid recovery. It will not do to say that in these cases the intestines were not injured. You will recall other cases in which it was certain that the intestines were injured; for instance, the case of the insane patient in the asylum at Utica, who got hold of a pair of scissors and stabbed herself in the abdomen. A knuckle of intestine protruded through the opening and she pulled it out and cut it off. The portion cut off measured eleven inches. The ends of the intestine receded and were not to be reached. The patient was put to bed and profoundly under the influence of opium and recovered. We know that nature sometimes accomplishes wonders.

The question still remains, How shall we make the diagnosis? I confess that I do not know absolutely. I, however, decidedly incline toward the use of diagnostitial laparotomy. My friend from Maryland, gave us an excellent paper on that subject last year, which I have not forgotten. I think that we are fully warranted in saying that we may resort to laparotomy for the purpose of diagnosis. *When* shall we resort to it? When we are in doubt, when the doubt overwhelms us. In those cases of injury of the abdominal cavity, with probable injury to

the abdominal contents. In those cases in which we find ourselves overwhelmed with doubt, we can advantageously resort to laparotomy to clear up our doubts. While I appreciate all that has been said with reference to the gravity of this procedure, and while in private practice we must be guided by the wishes of the patient and his friends, still I think that we are warranted in advising in favor of laparotomy for purposes of diagnosis.

Dr. David Prince, of Jacksonville, Ill.

Simeon Fernandez, aged thirty, was accidentally shot June 30, 1886, at 9.30 A.M., by a 22 calibre rifle ball at long range. He was seen a half hour afterward, and found complaining of intense pain on the right side, a little above and within the anterior-superior spinous process, between it and the median line.

The mark of the entrance of the ball was about one inch above the middle of the crest of the right ileum. Morph. 0.033 was given hypodermically. He was conveyed to my operating room, and placed under the flow of sterilized air, and the operation of exploration commenced at 11.50 A.M. under anæsthesia.

An incision was made in the median line, but abandoned on account of intestinal adhesions resulting from some old peritonitis. A crescentic incision was then made inside of the ileum, in the probable site of the intestinal puncture, should one be found. A considerable amount of small intestine was pulled out without finding any injury; but on exploring the colon, some ecchymoses were seen, which led to the discovery of a perforation deeply hidden under the liver, where the ascending colon becomes transverse. No other intestinal wound was found, from which it was supposed that the bullet must be in the intestinal canal, having spent its force, though it was never found. After wiping off the effused intestinal contents, the opening was closed by a puckered form of sero-serous suture, bringing the serous surfaces together by means of whale-tendon filament, leaving the ends long enough to hang out of the wound, surrounded by a rubber tube for drainage. The wound was closed with catgut suture material of large size, and a pump applied to the rubber tube every few hours. The incision in the median line was closed with large catgut filaments.

There was some evidence of shock before the operation, though the temperature was 99⅘°, and after the conclusion of the operation, lasting one hundred minutes, the temperature was the same, rising in the course of the day to 100⅘°.

During the following week the pulse ranged from 90 to 116, the respirations being about 28, and the temperature from 99.5° to 102°. The amount of morphia required gradually lessened. Quinine was given every day. A small amount of suppuration occurred in each wound. The patient was very much troubled with nausea and vomiting, having been dyspeptic before the operation.

July 18, or 19th day. The temperature was up to 103.5°, and antipyrin in doses of a gramme (15 grs.) was found to reduce it, while quinine had failed to control it.

32d day. Temperature 102°.

After this date the patient began to have febrile exacerbations, the temperature rising to 104°. Antipyrin always depressed the temperature.

45th day. There were pain and constipation during one week, after which cathartics and injections brought away some fluid containing pus. There was dulness on percussion and elevation of surface on the side operated on and inside of the anterior-superior spinous process.

After this 372 cubic centimetres of pus were aspirated from this place, having a fecal odor. The amount of four grammes of undiluted liquid carbolic acid was injected into the pus cavity.

60th day. The patient had symptoms of taking cold, coughing freely. This was followed by dulness over the lower portion of the right pleura, and for two weeks pus was expectorated, and on one day a considerable amount of blood.

The probable explanation is, that a line of escape of pus was formed behind the liver and up through the adherent pleural membranes, and out through the right lung. The patient made ultimately a perfect recovery.

This case suggests that the plan of making the incision in the median line was a mistake, in consequence of the old adhesions encountered, and the question arises whether or not in any case of injury, the better way is to make the incision over the probable situation of the intestinal perforation.

In the last two years I have made two other laparotomies for injury, both terminating fatally. In one case a man was taken from jail by a mob and shot in several places. There were two wounds of the bladder, one on the serous surface and the other in the triangular portion of the base of the bladder below, the shot passing through the sacrum. There were five wounds of the intestine. About six hours after the injuries were received, the abdomen was opened and the per-

forations found and sutured. The man seemed to be in good condition, but in twelve hours died, probably of acute peritonitis.

The other case was a stab wound by a penknife, causing a wound of the stomach about three inches in length. The wound was found with some difficulty, for the stomach had evidently moved from the position that it occupied at the time of the injury. The wound was sutured, but in three hours the patient suddenly died in an unaccountable manner.

As fecal matter had escaped into the peritoneal cavity in the gunshot case, it is highly probable that the irrigation practised at the time of the operation may not have been sufficient, and that provision should have been made for douching and aspirating drainage during the progress of the case.

In the stabbing case, provision was made for drainage, but death occurred too soon for any advantage to be derived from it.

Another case—recovery without operation. About three years ago a sheriff was shot through the abdomen by two bullets, in attempting to arrest a criminal. He was carried several miles to his home. Five days afterward there was a moderate degree of tympanites, and this circumstance was made the basis of a favorable prognosis.

It was at first a case for operative interference according to present ideas, but five days having elapsed without extreme symptoms, it was reasonable to suppose that any escape which might have occurred from the intestine into the peritoneal cavity had been enclosed in adhesions, so as to be in the condition of an abscess. The patient made a slow recovery. This recovery should not be held as evidence that laparotomy should not have been made in the few hours following the injury.

DR. T. G. RICHARDSON, of New Orleans.

I shall occupy the attention of the Association for a single moment. I wish to make a slight criticism on Dr. Nancrede's paper. I do not intend to throw any discredit on his recommendation of exploratory laparotomy. He evidently is in favor of performing this operation under all circumstances in cases of penetrating wounds, whether gunshot or made with a knife. He was careful to modify his recommendation by saying that this operation should always be performed by skilful surgeons. If we say that laparotomy should be performed by only certain surgeons, we cut off a good many cases from the benefits of

this operation. The large proportion of these injuries fall into the hands of the country practitioner, who can hardly be considered skilful in the manner implied by Dr. Nancrede. If we are to establish the rule that the operation is to be done only by skilful surgeons, it might be inferred that it is only to be done by Fellows of this Association, and that all who are not Fellows should act upon their own judgment, the majority of whom would not operate, and they would be considered justified in their refusal.

I should like, also, to give my observation and experience in connection with one of the largest hospitals in the South, the Charity Hospital of New Orleans. In this institution a large proportion of cases of penetrating wounds of the abdomen get well without laparotomy. Looking over the statistics of the Hospital for the last five years, I find that there have been during that time thirty-one cases of penetrating knife wounds, with twenty-four recoveries and seven deaths. There were thirty-three cases of gunshot wounds, with thirteen recoveries and twenty deaths. Laparotomy was performed in one of the fatal cases. In the others no operative measures were adopted. This gives a total of sixty-four cases of penetrating wound of the abdomen, with thirty-seven recoveries and twenty-seven deaths.

Dr. D. Hayes Agnew, of Philadelphia.

I want to place myself upon record, for I have very strong convictions with regard to laparotomy. They amount to this: If there is a reasonable degree of evidence that there is a penetrating abdominal wound, especially if a shot wound, it is our duty to open the abdomen, to make an exploratory incision. We are not to be deterred by the possibility of some legal technicality, if the case should come into court. We are to do our duty without reference to the consequences.

Dr. N. P. Dandridge, of Cincinnati.

I wish to refer briefly to a case of gastrostomy which I had last fall, and which, I think, can advantageously be considered in connection with this subject. The operation was performed on a child four years of age, for stricture following the swallowing of washing-fluid. The operation was performed about six months after the accident. The child was emaciated to the last degree, and for ten days prior to the operation had been unable to swallow anything. We attempted, without success, to nourish her by the rectum. The operation was

made as usually directed by Howse's method, the outside line of sutures being used in the peritoneal covering of the stomach, and the organ connected to the edge of the wound by another line of sutures. The condition of the child was so desperate that, when the operation was concluded, it was deemed advisable to introduce at once nourishment and stimulus. In order to avoid the danger of at once opening the stomach, the aspirator was resorted to, and one ounce of milk with half an ounce of whiskey was thrown in. The child was nourished in this way for two or three days, and the quantity of fluid was gradually increased until four or five ounces were used at one time. The immediate result was very satisfactory. The recovery was uninterrupted for six weeks, when the child contracted measles. From this time it gradually lost ground. The wound, which had entirely healed, ulcerated, and the child finally died.

I report this case in connection with the consideration of the process of repair in the abdominal organs, to show that by this method we can use the aspirator to administer nourishment and stimulants immediately after the operation, without any fear of extravasation of fluid into the abdominal cavity. In this case the introduction of the needle did not cause any pain, and she always expressed herself as feeling comfortable after the fluid had been thrown in.

I should like, in this connection, to report briefly the case of gunshot wound of the intestines referred to by Dr. Conner.

J. M., aged thirty, Irish, laborer, was brought to the Cincinnati Hospital at 2.30 A.M., July 5, 1885, for a gunshot wound of abdomen, received a short time before. The wound was an inch and a half to the left of the median line, and three inches below the umbilicus. The pistol (38 calibre) had been fired at a distance of only a few feet. On admission he complained of pain; pulse 84, temperature 97.4°. Morphia was given hypodermically, and the wound, after being cleaned, was covered by a compress wet with a bichloride solution. At 10 A.M. I saw him for the first time; pulse 96, temperature 99.6°. He complained of little pain, the abdomen was not distended, and the urine drawn by the catheter was free from blood. He had not vomited. As his present condition did not justify interference, the wound was not disturbed.

During the day he vomited, the matter ejected being free from blood. The abdomen became distended, and evidence of commencing peritonitis was evident; pulse 120, temperature 101° at 7.30 P.M. After consultation with Drs. Conner and Walker, it was decided to explore

the wound, and, if the cavity had been opened, to perform laparotomy at once, and seek for any wounds in the bowel which might have occurred. On opening the peritoneal cavity evidence of peritonitis was at once found. The small intestine was carefully drawn out and placed between towels soaked in a warm bichloride solution. The perforations were soon found—seven openings within a distance of three inches, and two more a short distance from them. The section containing these openings was brought well out of the cavity, and the contents of the intestine were gently squeezed out by Dr. Conner, who then grasped the gut above and below, and so prevented further escape while the openings were all carefully closed. The continuous suture was used, the line running parallel with the long axis of the bowel, except in the largest and most ragged opening, where it was transverse. This was the only opening not tightly closed at the autopsy. Catgut was used for the suture. The peritoneal cavity was very carefully washed out with a warm (1 : 10,000) bichloride solution, and the wound closed by bringing together the edges of the peritoneum by catgut, and then a line of silk sutures which included the entire thickness of the wall. Two large rubber drainage tubes were left in place. Time of operation, two hours, during which two hypodermics of whiskey were given. He reacted slowly, and during the night received several hypodermics of morphia for his pain. Symptoms of peritonitis continued to develop, and the patient died at 3.15 P.M., July 7th. The operation was made within nineteen hours after the injury, and death occurred forty-three hours later.

The autopsy was made by Dr. Eichberg, pathologist to the Hospital. The intestines were distended, and covered with recent lymph. At the lower part of the abdomen the intestines were matted together, so that it was necessary to tear through the adhesions in order to unfold the coils. In so doing there was an escape of pus and fecal matter from one of the wounds in the intestine. Whether the stitches had given way, or it had been torn open in unfolding the adhesions, it was impossible to say. What fluid escaped was located in a pocket which was completely encapsulated, and could not have been connected with the general cavity.

The small intestine had been perforated in nine places, all so firmly closed that neither gas nor intestinal contents escaped after the operation; no opening had been left ununited. No wound of the mesentery was found. The bullet was found imbedded in the horizontal ramus of the pubes.

Dr. Joseph Ransohoff, of Cincinnati.

I should like to report two cases which I have recently seen which terminated fatally without operation, but in neither of which was shock present. The first case was that of a young man with stricture of the rectum, which had existed for several years. He came under my observation in January. The stricture was so high that it could just be reached, and below the stricture the rectum was very extensively ulcerated. The feces were, of course, tape-like, and were tinged with blood. By a process of gradual dilatation I was able to pass the largest of the soft rubber bougies. This did not maintain the amount of dilatation which I desired, and I therefore resorted to the largest size of the hard rubber bougies. This I passed eight or ten times without difficulty. The last time I passed it without difficulty, but the patient complained of a good deal of pain. The bougie was at once removed. I saw the patient two hours later. He then had a good deal of pain in the left iliac region, with sensitiveness and vomiting. Twelve hours later I telegraphed to his physician that the patient probably had perforative peritonitis. I had two friends see him in consultation. The medical gentleman thought that it was not the time for laparotomy, and the surgical friend thought that laparotomy was not indicated. There were pain, tenderness, constipation, and the passage of a small quantity of blood. Twenty-four hours later, the physician had concluded that laparotomy was indicated, but the surgeon still thought that it was not, since the stricture was probably malignant. The patient died six days later with all the symptoms of perforative peritonitis. It was impossible to secure a post-mortem examination. The question is, Would we have been justified in opening the peritoneum?

Only last Sunday, at 6.30 p.m., I was asked to see a man who had been shot in the back with a pistol (calibre 45). He had a number of wounds; one through the thigh, one through the hand, and one through the back. The pistol was discharged at a distance of fifteen feet. The shot penetrated above the crest of the ilium, and apparently took a course forward. I saw the patient one hour after the receipt of the injury. The pulse was 84 per minute, and he had walked quite a distance after being shot. He complained of some pain in the abdomen, and had vomited after being shot. This was probably due to excessive indulgence in beer as much as to anything else. The vomiting continued during the night. From the direction of the wound, I concluded that it was a penetrating wound. I asked Dr. Conner to

see the case, in consultation, to determine whether or not laparotomy was indicated. At this time the patient was in a condition of collapse, and it was decided to use stimulants, and, if the patient rallied, to open the abdomen. He failed to respond, and died four hours later.

It was probably fortunate that, in this case, laparotomy was not done. The autopsy showed the following: The bullet which entered the back passed downward, outside of the peritoneal cavity, and struck the left ilium about the ilio-pectineal line. Here it splintered the bone slightly, and was deflected, passing into the peritoneal cavity. It first struck a knucle of the sigmoid flexure, and made an elliptical perforation, and in this was lodged a spiculum of bone. The ball then passed four times through a knuckle of the ileum, twice through the ileum at another place, and once through the ileum and mesentery at their junction. There were eight perforations in all. One of these was situated in the posterior aspect of the flexure, and could never have been detected *intra vitam*. The ball was found imbedded in the rectus muscle, very near the median line of the body, about two and one-half inches above the symphysis. The intestines were distended, and the peritoneal cavity was filled with a reddish-brown fluid, with particles of feces mixed through it.

Laparotomy was the only thing that could have saved this patient; but would it have done so? In the first case, I think that it is at least possible that laparotomy would have saved the patient. In the event that the stricture could not be excised, it is quite probable that the upper portion of the bowel could have been drawn into the abdominal opening, and the lower portion of the rectum entirely shut off.

Dr. John B. Roberts, of Philadelphia.

I wish to report two cases of stab-wounds of the intestines treated by me by opening the belly and suturing the intestines. The first case, which occurred about a year and a half ago, died; the second recovered. The recovery was apparently due to the method of treatment. The death occurred, apparently, because of the method in which I did the operation. I very unwisely, as I now think, enlarged the wound, instead of making a median section. Hence, I had to work through a thick, muscular part of the abdominal wall, and found it very difficult to examine the gut properly. As a result, the time occupied was long, and, on account of the patient showing symptoms of collapse, I closed the wound, thinking that I had sutured all the intestinal punctures. Death at the end of a day and a half or two days revealed peritonitis,

and an unsutured perforation larger than those which I had closed. If I had made a median section, I should probably have discovered the additional wound and saved the patient's life.

Dr. Nancrede. I feel highly complimented, not only by the approval of some portions of my paper, but also by the somewhat adverse opinions which have been expressed. I must positively decline to accept the imputation that I am enthusiastic about the operation. I may, in my efforts to present both sides of the question, have unfairly represented one. My only enthusiasm was for humanity and the profession. As I stated in the first few sentences of my paper, almost the sole object in presenting this subject for discussion was to secure an expression of opinion which would be authoritative and serve as a precedent for appeal in legal cases; which would enable the profession on the one hand to decide wholly in the interests of the patient, and not be swayed by any fear of legal complications, and, on the other hand, that the criminal should not escape. Logically, I was driven to the conclusions that I expressed. The fact that I omitted some portions of the paper, and did not read the foot-notes, has caused misapprehension on the part of some of the Fellows.

Some surprise has been expressed at the painless nature of the death in some cases of hyper-acute peritonitis. I have stated that in hyper-acute cases it was rare to have any of the symptoms ordinarily recognized as appertaining to peritonitis. The shock is so profound that there is absolutely nothing but collapse.

I should like to call attention to Dr. Kinloch's case, in which he refers to the silver suture giving way, as proving the wisdom of the advice I gave. The peritoneum should be sutured with silk or catgut before the attempt is made to bring the other tissues together. Since there is no laxity of the abdominal walls, such as is the case after removing a tumor, it is almost impossible to bring the peritoneal surfaces in contact without great traction, and any suture is liable to break or produce inflammation by tension.

I cannot understand how it is possible to obtain such favorable results as the Fellow from New Orleans reports. The records of the Crimean war, of our own war, and, certainly, the experience of surgeons in Philadelphia, do not bear out the statement that a large proportion of recoveries follow gunshot wounds of the abdomen. I have confined myself to ball-wounds entirely; the New Orleans statistics include many stab wounds. An incised wound does not slough, whereas,

a ball-wound will. I would emphasize the statement which I have made, that the *tendency* of these wounds is toward death. Although nature may occasionally successfully obviate this tendency, still the *tendency is to death.* Exceptions do not prove the rule. The weight of evidence is on the side of the fatal termination of ball-wounds involving a viscus. As showing the absence of symptoms, even with severe visceral injury, in my case, where the stomach was twice wounded, the child vomited repeatedly, but brought up no blood for an hour and a half after the injury. Primary fecal extravasation may not occur, and often does not occur, as the contraction of the circular fibres may be sufficient to close the opening. Secondary fecal extravasation will occur if the patient lives long enough for sloughing to take place, provided safe adhesions are not formed.

Contusion, as is proven by Dr. Keen's case, will produce mortification and death of the part, and death of the patient. Therefore, the advice that I gave, that the slightest contusion should be excised, is borne out by actual clinical experience.

Under proper precautions, exploratory laparotomy, to determine whether or not penetration has occurred, is not such a dangerous procedure. We must think this in view of the number of such operations constantly done without evil effects. I do not think that shock is at all a reliable symptom of penetration of the peritoneum, unless the injury is in the region of the sympathetic. Shock often means hemorrhage. I do not think that depression of temperature is any more reliable.

The statement has been made that the healthy peritoneum will resent laparotomy. If there is any truth in experimental observations, the reverse is correct. If the peritoneum is healthy, it can dispose of a considerable quantity of feces, urine, bile, blood, and various other matters, and even septic microörganisms. The moment that the power of absorption of the peritoneum is impaired, then the operation becomes more dangerous. It is probable that the greater success now attending the early operations in various abdominal diseases is due, not so much to antiseptic surgery—which I believe in—as to the fact that the peritoneum is still healthy, and disposes of a great deal of blood, etc., which is not removed.

With reference to the diagnosis, I think that in most cases the question of peritoneal penetration can be safely determined by an incision down to the peritoneum, following the track of the ball, the

operation being conducted with as much care as though about to do a laparotomy. In certain cases this cannot be done. If penetration is found, I maintain that even when there is no wound of the viscus many cases will do better, if laparotomy is performed, a careful toilet made, all foreign matters removed and free drainage provided, so that any fluids that remain shall not become stagnant. I have only to call attention to the fact that in the practice of our President—*i. e.*, the experience of one surgeon—in a short time four cases occurred, proving fatal from a condition of things which it is possible to obviate by operation.

All the symptoms relied on to determine visceral penetration are fallacious. They are relied upon by the gentlemen who oppose laparotomy, to prove that penetration has taken place with recovery in many instances. I would ask, What is the proof that these cases ever suffered peritoneal, much more visceral perforation? Could not the peritonitis have been produced by the contusion, etc.? This is comparatively a very simple condition. When a gentleman can take, say, one hundred cases and prove without a doubt that peritoneal and visceral penetration has taken place, and recovery has followed without operation, then the ground is cut from under my feet. Until this has been proven, I contend that the vast majority of cases of recovery, in which there is supposed to have been penetration of the peritoneum and wounds of the viscera, were really not cases of this kind.

I differ from those who assert that nothing with reference to diagnosis has been added by what has been said. I think that that position is hardly tenable. The first step toward knowledge is to know what we do not know, to realize how ignorant we are. If we know that all the so-called diagnostic signs are fallacious, we shall not rely on them, but do as has been recommended, viz., cut down carefully in the track of the ball. If the wound can be followed to its termination and there is no opening of the peritoneum, it should be let alone. If there is any doubt, the section should be made. This is, after all, the only certain way of knowing.

Some have objected to my recommendation of a median cut. The neglect of this has caused death in certain cases. In this operation we are not examining the intestines after the removal of a large tumor, leaving the abdominal walls in a lax condition. We are working through a button-hole. In one or two cases in which the lateral incision was resorted to, intestinal wounds have been overlooked and the patients have died from extravasation and hemorrhage. In my own

case, I cut down to determine whether the ball had penetrated or not. I found that it would have been impossible to examine the wounds through this opening unless I had extended it from the ensiform cartilage to the pubes, while a small incision in the median line enabled me to do all that was necessary.

Exception seems to have been taken to the remarks with reference to skill. Skill generally means acquaintance with all contingencies, due preparation, and attention to detail. It does not necessarily indicate manual dexterity. The examinations must be thorough, even an experienced hospital surgeon has in his hurry overlooked a wound of the bowel. Again, owing in part to a want of that thorough preparation which I urged in the paper, two patients recently died under exceptionally skilled hands, with in one case exceptionally skilled assistants. One case died of hemorrhage the moment the parts were reached. If a tampon had been ready, the hemorrhage might have been checked. If the thermo-cautery had been ready the bleeding might have been stopped. The ultimate result might have been the same, but the surgeon would have felt his conscience a little clearer. I said that the operation should be performed by skilled and experienced operators. There is one recent case of recovery under the most adverse circumstances. I said that under favorable surroundings with an exceptionally favorable case any one might with *due precautions* undertake the operation. I suggested what it would be best to have, *if possible*, but in case of emergency the operation might be done with most ordinary precautions, provided the operator have this skill, namely, a knowledge of what may have to be done, and will pay attention to details. Personally, I have no hesitation in saying that if I should have a wound of the intestine, I should rather be left to nature than be operated on by a nervous, worried, excited, careless surgeon. I think that the chances, which would be next to nothing, would be in both conditions on a par, and I should rather not undergo the discomforts of an operation.

With reference to the treatment of the peritonitis that may result, I think that as long as we continue in the routine track pointed out by Dr. Alonzo Clark, many patients will be killed with opium who otherwise might be saved. If we recognize the fact that peritonitis is not one disease, that it does not always present the same symptoms and is not always to be treated in the same way, I am inclined to think that even some of the most desperate cases will recover.

Dr. Kinloch. There is one point in the discussion which has gratified me as an advocate of laparotomy, and that is, that two of our most distinguished Fellows have said deliberately and with emphasis that such operations should be performed. That is the point that we want to get at. Where two such gentlemen will utter such opinions to go abroad in this county, then those of us of less experience who advocate this operation have nothing to fear. Others who have discussed this subject have done so in a very judicious but cautious way. I noticed that the main question hinged on the uncertainty of diagnosis, whether or not when a man was shot in the abdomen we could say that the bowel was injured or not. If we are going to wait and postpone operation while the diagnosis is uncertain, we will always be powerless. We cannot look into the belly without opening it. There never will be any way of reasoning out a plainer diagnosis in the cases of gunshot wounds that we are discussing. It was this very fear of being criticised with reference to the diagnosis, that checked the progress of surgery so far as ovariotomy is concerned, but where are we to-day as to this operation? It was this fear that checked the progress of surgery in connection with operation for injuries of the head, and where is that to-day? How often is it that the surgeon makes an exploratory operation to verify the diagnosis and saves the patient from disease of the brain? Is not this sanctioned now as to abdominal tumors, and in other conditions affecting the abdominal cavity? Many of the older surgeons indicated that this might be a good practice in abdominal wounds such as we are discussing, that it was judicious, and that in time we might come to it, but none of them acted. Let us now illustrate the difference between the surgery of the past and the surgery of the present.

In regard to the question who should do this operation, my friend from Philadelphia spoke of the advantages of a skilled operator and the necessity for detail. We all agree to that, but, as my other friend from Philadelphia said, every man must do his duty, and this question of duty comes sometimes to the so-called country practitioner as well as to the more skilled man of the city. Because a poor negro is shot in the cotton-field and carried into a negro cabin, and the only surgical assistance available is a man who never did a laparotomy, is this a reason why the sufferer should be debarred of his only chance? We must do our duty to the sufferer, and we must look to this to refute any criticism.

In this connection I may refer to a little experience in connection

with the first case that I operated on. I had invited an older physician to witness the operation. When the abdomen was opened and the bowel turned out this gentleman disappeared. I subsequently learned that he had left the hospital "because he was disgusted with Dr. Kinloch's inhumanity." When the patient recovered, that gentleman was one of my admirers. Not many months ago he came to my city there to end his life. During this last illness he would have no one to attend him but my humble self.

One word with regard to Dr. Nancrede's remarks with reference to the suturing of the peritoneum. This is a very good point theoretically. But if my friend had assisted in my operation on the very athletic man, he would have agreed with me that it was impossible to bring the peritoneal layer together separately and primarily. It was with great difficulty that we could crowd the intestine in, and only by adroit passing of the needle after getting hold of the whole abdominal parietes could we keep the parts together. This idea of first bringing the peritoneal surfaces together has been dwelt upon in connection with ovariotomy, but after some experience I have reason to believe that it is of doubtful advantage. I have concluded that patients do as well without this precaution, and that a series of deep sutures, going through all the structures is all that we need. Even if, in the case referred to, it had been possible to introduce separate peritoneal sutures, they would, I think, have torn out from the tension of the abdominal structures.

REPORT OF A CASE OF VENTRAL HERNIA SUCCESSFULLY TREATED BY OPERATION, WITH A SUGGESTION AS TO THE METHOD OF OPERATING.

By J. EDWIN MICHAEL, M.A., M.D.,

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Mrs. F., a stout, robust woman, forty-five years of age, fell several years ago, while engaged in some domestic duties, in such a way that she was struck in the median line, about halfway between the umbilicus and the pubis, by the handle of a washtub. The wound caused a break in the linea alba, without breaking the skin, and soon afterward the intestine protruded. No peritonitis followed the injury. Her physician directed her to wear a bandage and pad to keep the intestine within the abdominal cavity. This arrangement, however, proved unsatisfactory, in that upon the slightest exertion, even that of walking, the intestine protruded, and getting between the pad and the belly-wall, gave great discomfort. She consulted other physicians, only to have different kinds of apparatus recommended, and by the time she fell into my hands had spent most of her substance in hernia belts. None of them had proved efficient. The location of the orifice between the umbilicus and pubis, upon a rather pendulous belly, seemed to make it utterly impossible to retain the hernia in a state of reduction by any of the devices known to instrument makers.

Upon examination, I found that in moving about, notwithstanding the pad she was then wearing, she carried a considerable portion of the intestine in the hernial sac. Reduction was easy—in fact, upon assuming the recumbent position the contents of the sac almost ran back into the belly by their own weight. The belly was full and fat, but with the hernia reduced it was easy to make out the opening in the median line at the point above named. It was of elliptical shape,

with the long axis perpendicular, and about two and a half inches in length, and presented a firm, hard, apparently cicatricial, margin. As taught by all authorities on the subject with whose views I was acquainted, I spoke of the pad as the proper treatment of the condition, and began to suggest modifications in the one she was using. She stopped me, however, with the remark that she had had enough of pads, and had come to me for operation, and that she would prefer death to such relief as pads and belts could give her. I explained that operation would possibly be dangerous to life, and perhaps, even if she escaped with her life, it would not be successful. Upon full explanation, she decided to have the operation done, and on March 15, 1886, I operated in the following manner, with ether as the anæsthetic.

The rooms to be occupied by the patient, together with all flannels and other stuffs to be used about her, were fumigated with chlorine and sulphur, and the antiseptic plan—as included in sublimate solution, 1 : 1000, for sponging, disinfecting hands, etc.; carbolic acid solution, 1 : 40, for instruments, and iodoform gauze for dressing the wound—carried out. A long, free incision in the median line, through skin and subcutaneous fat, exposed the sac, which was carefully separated from the surrounding tissue by finger dissection, down to its attachment to the margin of the opening. It was then emptied of its contents and carefully opened. No adhesion being present, and slight hemorrhage being controlled, the sac was cut off close to the margin of the ring. Stout silver wire sutures were now passed a little less than half an inch apart, and having a hold of about three-quarters of an inch, through the margins of the hernial ring, including peritoneal, muscular, and tendinous structures only. These wires were twisted and passed through a perforated shot, which, after being flattened, was neatly trimmed off, the wire being cut even with the surface, thus making a rounded, smooth finish to the sutures, which were intended to be permanent. The skin and subcutaneous tissue were now closed by continuous catgut suture, and half a dozen strands of coarse gut passed through its entire length for drainage. Broad strips of adhesive plaster strengthened the union of the parts, and a dressing of iodoform gauze, mackintosh, and cotton, with a broad flannel bandage, completed the operation. No shock was experienced. The patient recovered from the ether without nausea, and complained of nothing, save a little epigastric pain and a feeling of soreness at the seat of the wound. During the first few days after the operation, the patient was allowed nothing but a tablespoonful of milk every two hours, with

plenty of cracked ice, and was kept mildly under the influence of opium by the administration every four hours of ten drops of the deodorized tincture. The following record shows the progress of the case.

March 16. A.M., temp. 99°; pulse 80. P.M., temp. 100.2°; pulse 88.

17th. A.M., temp. 99.8°; pulse 96. P.M., temp. 100.2°; pulse 88 (tongue dry).

18th. A.M., temp. 99.8°; pulse 96. P.M., temp. 100.9°; pulse 98.

19th. A.M., temp. 98.9°; pulse 90. P.M., temp. 99.8°; pulse 89.

20th. A.M., temp. 99.5°; pulse 82. P.M., temp. 99.7°; pulse 90.

21st. A.M., temp. 99°; pulse 86. P.M., temp. 98.6°; pulse 88.

22d. A.M., temp. 98.9°; pulse 84. P.M., temp. 98.8°; pulse 86.

The dressings showing some discharge, the wound was exposed, cleansed, and redressed as before. The surface wound was united, and the catgut suture absorbed. A small amount of odorless pus was oozing from the lower angle, which was still open. No swelling, tenderness, or other sign of trouble. On the eleventh day after the operation there were considerable abdominal pain and straining, accompanied by a temperature of 101.3°. This was, however, due to constipation, and was happily relieved by a copious enema of soapsuds, followed by a large evacuation from the bowels. By the end of the second week the wound was practically healed, and the patient discharged with careful instruction as to the desirability of wearing habitually an abdominal bandage and pad. She wore a bandage for a few months, and then, feeling that there was no further necessity for it, discarded it.

She presented herself for examination in October, about seven months after the operation. She had then been engaged in her usual domestic work, without the aid of any support whatsoever, for about three months. The wound was firmly closed, and showed no sign of weakness. The wire sutures could be felt deeply in its substance, but gave no inconvenience. The patient was the picture of health, and very grateful for the change wrought in her condition by the operation.

I do not propose to weary the Association by statistics and quotations in regard to my case. Suffice it to state, that the authorities I consulted had nothing to say about radical operation under the circumstances presented, and I used my own judgment. The problem was to close an old, hard cicatricial

ring permanently, and that, after restoring to the belly cavity a large mass of intestine which it did not habitually contain. Most of us have known pins, needles, bullets, and such like foreign bodies to remain for years in the tissues without giving rise to trouble; and most of us have also observed upon removal of such bodies after they had become encapsulated that they were imbedded in a mass of very tough, hard, cicatricial tissue, and I based my manner of closing the ring upon these facts. I did not depend on any constant action of the wire sutures themselves, as I am perfectly aware of the fact that wire sutures, or any other kind, will cut through the tissues under constant traction; but I expected that the process of encapsulation would surround each of my sutures with such a mass of cicatrix that it would result in a strong and permanent closure of the ring. I used the permanent wire suture, without authority, and without precedent, so far as I am aware, and for the reasons just given, and am convinced that it added to the security without increasing the danger of the operation.

DISCUSSION.

DR. T. F. PREWITT, of St. Louis.

The admirable report of this successful case commends itself so much that there is nothing to say. The operation was admirably performed, and I think it was the proper thing to do. As the author has said, the result is doubtless dependent on the amount of exudation that has been thrown out. The result will probably be satisfactory although there is danger that, some time in the future, the tissue may give way. The cure may, however, prove permanent. I have operated on cases of strangulated hernia, and, although I have cautioned the patient to wear a truss, it has been thrown aside, and so long as the cases were under my observation there was no indication of a return of the trouble. The cure in these cases can hardly be considered a radical one. It is simply provisional, although it may be permanent, lasting during the life of the patient. Dr. Michael's course was right and proper, and the result very satisfactory. I have now a patient with ventral hernia who is wearing a pad, and it is my intention, if she is not relieved, to do an operation similar to that described.

THE PROGNOSIS OF SARCOMATA OF THE BREAST.

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MUCH obscurity exists in regard to the prognosis of the various forms of sarcoma of the female breast. Many practical surgeons and pathologists regard them, and particularly the cystic form, as being comparatively innocent, and only marked by a tendency to local reproduction. Some authorities, indeed, deny the possibility of the general dissemination of spindle-celled tumors, and assert that the tendency to recurrence will, in most cases, gradually wear itself out after the performance of several operations. Other teachers of equal reputation fully recognize the malignant attributes of this class of morbid growths, a fact which I certainly settled in my *Treatise on Tumors of the Mammary Gland*, published by D. Appleton & Co., of New York, in 1880. Since the appearance of that monograph, I have collated many additional cases of sarcoma of the breast, bringing the number up to 156, an analysis of which, with the view to throwing more light upon its life history, constitutes the *raison d'être* of this paper.

Of 92 cases, in which the final reports extend beyond the mere statement of the recovery or death of the patient, only 1 ran a natural course, it being an example of round-celled tumor of both breasts, which proved fatal, with presumed secondary deposits, in seven months from the first appearance of the disease. The remaining 91 were subjected to operation. Of these, 32 continued well for periods which varied between one month and ten years and nine months; 42 were marked by local recurrence; in 8, not only was the tumor reproduced, but

metastases were found post-mortem; 3 recurred with all the evidences of general dissemination; 4 were characterized by metastases, and 2 by presumed metastases, without local reproduction. In other words, 64.83 per cent. of all cases were endowed with malignant features. Let us examine these general statements more in detail.

1. 32 patients were alive and well for an average period of 49 months and 10 days after operation, the disease having existed, on an average, for 69 months and 11 days before surgical interference, so that the total life of these cases averaged nearly ten years. The period of freedom from recurrence after the last operation was:

From	1	to	12	months,		in	4	cases.[1]
"	1	"	2	years,		"	4	"
"	2	"	3	"		"	7	"
"	3½	"	4	"		"	5	"
"	4	"	5	"		"	5	"
For	7	years	and	3	months	"	1	case.
"	8	"				"	1	"
"	9	"	"	11	"	"	1	"
"	10	"				"	1	"
"	10	"	"	4	"	"	1	"
"	10	"	"	5	"	"	1	"
"	10	"	"	9	"	"	1	"

2. As has been seen, there was local reproduction in 53 cases. In 45, in which the date is noted, the periods of recurrence were as follows:

2	cases	in	3	weeks.		3	cases	in 12 months.
2	"	"	1	month.		1	case	" 15 "
7	"	"	2	months.		1	"	" 17 "
3	"	"	3	"		2	cases	" 18 "
2	"	"	3½	"		1	case	" 20 "
2	"	"	4	"		1	"	" 21 "
5	"	"	5	"		3	cases	" 24 "
3	"	"	6	"		1	case	" 29 "
1	"	"	7	"		1	"	" 32 "
1	"	"	8	"		1	"	" 36 "
1	"	"	9	"		1	"	" 48 "

The table shows that more than one-half, or 57.7 per cent., of the reproductions took place in 6 months, while after 12 months

[1] The shortest periods were 1, 4, 6, and 10 months.

there were 13, or 28.8 per cent., and of these there were only 4, or 8.8 per cent., after 2 years. These statements lead to the belief that the chances for the patient are relatively good after the lapse of two years, and that the prognosis is all the more favorable as the period of freedom from signs of local contamination prolongs itself. As the latest case of reproduction was 4 years, we may assume that the 12 cases of the first table which remained well after the lapse of that time, were permanently cured. The average date of recurrence was 10½ months, and the total life of these patients, from the first observation of the disease to the final report after the last operation, was 7 years and 9 months. The number of recurrences, or operations for recurrence, was 1 in 23 cases, 2 in 13 cases, 3 in 7 cases, 4 in 1 case, 5 in 4 cases, 6 in 2 cases, 7 in 1 case, 12 in 1 case, and 22 in 1 case.

While the average was 10½ months, the histological construction of the growth appears to have exerted a marked influence upon the date of recurrence. Thus, the mean date of local reproduction was 4 months and 20 days for the round-celled, 11 months and 27 days for the spindle-celled, and 12 months and 10 days for the giant-celled. The cystic tumors recurred in 8 months and 5 days, and the solid in 13 months and 9 days, and this contrast becomes the more striking when we state that the average date of recurrence for cystic round-celled growths was 3 months and 4 days as against 6 months and 8 days for the solid round-celled, and 9 months for cystic spindle-celled as against 16 months for the solid spindle-celled.

3. Of the 91 cases, metastatic growths, as demonstrated post-mortem, or by unmistakable evidences during life, had formed in 17, or 18.68 per cent. There can be no doubt that this estimate is too low, since of 20 examinations of persons dead from the effects of the primary operation or dead after secondary operations, metastatic growths were found in 12, or 60 per cent. The total duration of life, from the first appearance of the primary tumor to the death of the 17 patients, was 57 months, 9 months having been the shortest, and 25 years and 7

months the longest period. The relative frequency of the seats of the secondary deposits is shown by the following statement:

Lungs,	in 10 cases.	Pleura,	in 1 case.
Liver,	" 4 "	Heart,	" 1 "
Brain,	" 3 "	Kidney,	" 1 "
Retroperitoneal glands,	" 1 case.	Bones,	" 1 "
Dura mater,	" 1 "	Muscles,	" 1 "
Mediastinum,	" 1 "		

In connection with the malignity of sarcomata of the breast, the condition of the associated lymphatic glands is of very great interest. Of the 156 cases that I have collated, the axillary lymphatic glands were enlarged, and now and then tender, in 19. In 14 of these the enlargement was found to be present with the primary growth, but in only 1, a case of pigmented alveolar round-celled sarcoma, were tumor elements detected. In the remaining 5, the glands were extirpated along with recurrent growths, and in 2 of these, one an example of round-celled sarcoma communicated to me by Dr. Markoe, of New York, and the second a case of alveolar giant-celled tumor from the practice of Billroth, were the glands infected. Hence, the enlargement of the glands was due to irritative hyperplasia in 16, in 10 of which ulceration of the tumor was present, while they were infected in only 3. This immunity of the glands from contamination is remarkable, and is a valuable negative sign in the differential diagnosis of malignant mammary growths.

Another interesting feature of sarcomata, when contrasted with carcinomata, is the comparative absence of macroscopic evidences of local infection of the contiguous tissues, as it was met with in only 7 out of 155 operations, the muscles of the chest being invaded in 5, the paramammary fat in 1, and the perichondrium in 1. The tumor was cystoid spindle-celled in 1, simple spindle-celled in 1, cystic spindle-celled in 2, simple round-celled in 1, osteoid round-celled in 1, and cystic giant-celled in 1. Just how often the skin is involved is difficult of solution, since in some of the 29 instances of ulceration it was, doubtless, converted into sarcoma tissue, but microscopic data

of the fact are wanting. Be this as it may, the skin was adherent in 15 examples, of which 10 were cystic, and 5 solid tumors, the round-celled slightly predominating. If, in addition to the 7 cases of invasion of the muscles, perichondrium, and paramammary fat, these 15 cases be regarded as instances of invasion by tumor elements, sarcomata of the breast are to be regarded as locally infectious in 14.19 per cent. of all cases. It should, however, be borne in mind that the frequent recurrences after operation demonstrate that the surrounding tissues are converted into latent zones of infection which are not appreciable by the naked eye.

The prognosis is materially influenced by the age of the patient and by the size and rate of increase of the tumor. Thus, before the age of thirty-five, when the mammary gland is functionally most active, a small, slowly growing sarcoma does not return, while a rapidly increasing tumor, especially the cystic variety, is very liable to recur. Among the latter class of cases, 60.71 per cent. were characterized by recurrence, and 10.71 per cent. by metastatic tumors. Of these, the solid sarcomata recurred in 53.84 per cent., and gave rise to secondary growths in 7.69 per cent., while the cystic recurred in 66.66 per cent., and were marked by metastases in 13.33 per cent. It does not appear, however, as many writers assert, that the more tender the age, the more rapid the growth of, and the more malignant is, the neoplasm. Thus, of 15 cases, the ages of which varied from 9 to 19 years, or $16\frac{1}{5}$ years on an average, the tumor had been in existence, on an average, for $7\frac{1}{2}$ years before its removal, and 28.57 per cent. remained well, while 71.43 per cent. recurred, and metastases were not observed in a single instance. After the thirty-fifth year, on the other hand, and the danger increases with advancing age, the greater the is liability to metastases, as, in this class of cases, 19.35 per cent. were generalized, and 43.54 per cent. recurred. Of these, the solid tumors recurred in 47.05 per cent., and gave rise to secondary growths in 23.54 per cent., while the cystic recurred in 44 per cent., and were marked by metastases in 16 per cent. of all cases. In other words, a sarcoma occurring in a functionally active breast

evinces a marked disposition to recur after operation, with less disposition to metastases, while a sarcoma of the declining breast recurs less frequently, but is generalized in a greater number of instances.

The prognosis is also influenced by the histological constitution, and the stage of evolution of the tumor. Of the spindle-celled 13.18 per cent. infect the adjacent tissues,[1] 65.10 per cent. recur, and 20.40 per cent. give rise to metastatic growths; of the round-celled 17.64 per cent. infect the adjacent tissues, 60 per cent. recur, and 25 per cent. are generalized; of the giant-celled 25 per cent. invade the adjacent tissues, 57.14 per cent. recur, and in none are there metastases; of the solid 11.54 per cent. infect the adjacent tissues, 64.58 per cent. recur, and 25 per cent. are disseminated; while of the cystic 16.66 per cent. infect locally, 51.16 per cent. recur, and 11.62 per cent. are generalized. Hence, while the round-celled are the most malignant, the metastasis of the spindle-celled is by no means to be denied; nor can we say, with certain writers, that the cystic variety is an innocent tumor, or one of limited malignity, since it recurs in more than one-half of all cases, and generalizes itself in about one case out of every nine. These investigations demonstrate that the usual statements, which are so opposed to the actual facts, as to the malignity of the sarcomata, are due either to their not having been based upon a careful analysis of a sufficient number of recorded cases, confirmed by minute examinations, or to the confounding of cystic sarcomata with cystic fibromata, which never infect the economy.

While I have been unable to collate cases in which the disease ran a natural course, through which we are deprived of dates bearing upon the duration of life in this class of patients, and comparing them with those subjected to the knife, there can be no doubt that operations do result in permanent recoveries, and prolong life, even if a final cure is not attained. From an inspection of the two tables on page 234, it appears that recurrence may be delayed four years, and that 12 subjects were

[1] This estimate is based upon the gross evidence afforded by operations.

alive and well after four years.; so that, if we take four years as the criterion of safety, the 91 operations show 13.18 per cent. of cures.

Although the recurrent regional disease is more intense than the primary, and other reproductions generally follow in quick succession, the removal of tumors as fast as they appear certainly alleviates suffering, prolongs life, averts visceral contamination, and, occasionally, brings about a cure. Thus, Bryant removed the entire breast for a round-celled sarcoma on January 9, 1883, and up to February 10, 1886, performed twelve operations for multiple recurrent growths, the opposite breast being the seat of an atrophic scirrhus of sixteen year's standing. Billroth[2] enucleated a cystic sarcoma, and removed four recurrent growths in four years, the breast being extirpated at the last operation, and the woman was free from disease three years subsequently. Erichsen[3] extirpated the entire breast for a cystic growth of twenty-seven years' standing, in 1859, and removed recurrent growths in 1861, 1863, 1864, 1865, and 1866, death ensuing from paralysis "some years after the last operation." In Heath's[4] case of removal of the gland for a spindle-celled tumor, six operations for recurrence were done in thirteen years, and the patient was alive with a seventh recurrence. In that of Haward,[5] a spindle-celled tumor was removed in 1860, and recurrent growths were excised in 1863, 1869, and 1873. The patient died, without metastases, from the effects of the last operation, but life was prolonged, as in the preceding instance, for thirteen years. Riedel[6] removed six recurrences in twenty years, following an operation for giant-celled sarcoma, and, on death, there were no metastases. Gay,[7] in May, 1865, enucleated from the same breast two cystic spindle-celled sarcomata of six

[1] Private communication, March 6, 1886.

[2] Die Krankheiten der Brustdrüsen, p. 68.

[3] The Science and Art of Surgery, 8th Amer. ed., vol. ii. page 711.

[4] British Medical Journal, 1878, vol. i. p. 194.

[5] Trans. Clin. Soc., London, vol. vii. p. 106.

[6] Centralblatt für Chirurgie, 1881, Bd. 58, p. 636.

[7] Trans. Path. Soc., London, vol. xvi. p. 240; vol. xx. p. 359; vol. xxv. p. 233; vol. xxxi. p. 272; and vol. xxxiii. Suppl. p. 24.

years' standing. Recurrent growths were removed in July, 1867, with the entire gland; in May, 1869; in May, 1874; in June, 1878; in May, 1880, and in June, 1881, so that life was extended for fourteen years, and the woman was still living at the date of the last report. The case of S. D. Gross,[1] however, is, so far as I know, the most remarkable on record. In March, 1857, a single woman, aged forty-four, discovered a small tumor in the left breast, which, on enucleation the following October, proved to be a spindle-celled sarcoma. During the next sixteen months two more partial operations were performed; and a fourth tumor, along with the entire breast, was extirpated in May, 1859. In three months and a half the knife was again required, and soon afterward other tumors were removed. In 1860 she underwent eleven operations, and six in 1861, the last of which was performed in September of that year, so that she was subjected to twenty-two operations for fifty-one recurrent tumors in four years. They varied in size from an almond to a hen's egg: appeared at or near the cicatrices in a few weeks, and rapidly assumed a fungating aspect. Large portions of the pectoral muscle, and also of the external and internal intercostal muscles were cut away, so that during a deep inspiration there was a slight protrusion of the pleura. Ten years and nine months after the last operation she was in perfect health. In these eight cases there was no lymphatic involvement, and the general health was unimpaired.

A study of the preceding facts shows that, like carcinoma, sarcoma is a malignant growth. It differs, however, from carcinoma in many important features, which are shown in the following statement:

	Sarcoma.	Carcinoma.
Invasion of the skin by tumor elements	9.67 per cent.	68.92 per cent.
Invasion of the chest walls	3.87 " "	21.58 " "
Invasion of the paramammary connective tissue	0.64 " "	8.39 " "
Primary invasion of the axillary glands	0.64 " "	67.35 " "
Local reproduction after removal	58.24 " "	80.97 " "
Metastases found post-mortem	60. " "	50. " "
Average duration of life	81 months.	39 months.
Permanent cures	13.18 per cent.	10.39 per cent.

[1] A System of Surgery; 6th ed., vol. 2. p. 974.

From this table it appears that sarcoma is less infectious locally, but more infectious as regards the general system, than carcinoma. Its more relatively benign character is shown, not only by the larger proportion of cures, but also by the fact that the average duration of life, from the first observation of the disease to the date of last removal after operation, is forty-two months longer; and this contrast becomes the more striking when it is stated that the majority of the sarcomatous patients were still living, and the majority of the carcinomatous subjects were dead. Not only is this statement true for sarcomata in general, but it holds good for the three varieties, since the average life for round-celled sarcoma is fifty-four months, ninety months for the spindle-celled, and one hundred and eight months for the giant-celled.

From the data which I have presented, the following conclusions may be formed:

1. That sarcomata of the mammary gland, including the cystic variety, which is usually considered to be a comparatively benign growth, are neoplasms of decided malignity.

2. That surgical intervention prolongs life, and frequently results in permanent recovery; and that local reproductions do not militate against a final cure, provided they are freely removed as fast as they appear.

3. That the subjects are absolutely safe from local and general reproduction if four years have elapsed since the last operation.

MEDICO-LEGAL ASPECTS OF CRANIAL AND HEART WOUNDS.

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Is it possible for an individual, with suicidal intent, and in quick succession, to inflict a perforating shot wound of the head and another of the chest implicating the heart? Or, reversing the proposition, Is it incredible that a person, bent on self-destruction, can, with his own hand, shoot himself in the heart, and in the head? These questions have a medico-legal bearing of no small import, and have been suggested as the subject of the present paper, by a murder committed during the spring of 1886, in the town of Newport, Rhode Island.

A colored man, long a resident of Newport, well known both to the permanent inhabitants of, and to many transient visitors to, this place of fashionable resort, was found one morning in his house dead under the breakfast-table, having in his mouth some food unswallowed, and with a bullet wound in his head and another in his chest. A coroner's jury, after holding an inquest, brought in a verdict of suicide, and the body, under this finding, was interred. Some weeks later, through the suggestion, I believe, of one of the local physicians, that it was impossible for the deceased to have inflicted these double wounds with his own hand, both involving vital organs, the authorities ordered the body to be disinterred and the inquest to be reviewed. The autopsy revealed a perforating shot wound of the skull, the pistol ball (22 calibre) having entered the right parietal bone about two inches above and anterior to the ear, making a clean-cut perforation of the skull and lodging in the

posterior part of the left half of the cerebrum, having passed from left to right, and from before backward. Another ball had penetrated the thorax at a point three inches to the right of the left nipple, and two inches to the left of the median line. "The ball," as was stated, "was found to have passed through the left ventricle of the heart, entering the base and emerging at the apex." It is probable that the exact point at which the ball entered the chest was not accurately noted, as it would have been an anatomical impossibility for the missile, entering the thorax at the position stated, to have traversed the heart from base to apex, the base of the organ being on a level with the second costal cartilage.

The finding of the coroner's jury, based on the evidence developed by this second examination, was murder by some person or persons unknown. Suspicion now fell upon the son-in-law of the dead man, who lived in the same house with his father-in-law. This colored man, named Dorsey, was a graduate of Lincoln University, and had attended two courses of instruction in the Medical Department of the University of Pennsylvania. He was immediately arrested, imprisoned, and held to answer for the murder. He stoutly denied any participation in, or knowledge of, the crime, and as the young man had, both during his student life at Lincoln University and at the Medical Department of the University of Pennsylvania, borne a remarkably excellent character, and as no possible or sufficient motive, at the time, could be divined for such an act, many of his friends were disposed to regard him as innocent. These convictions were strengthened by the rumor that Burton, the murdered man, was hopelessly embarrassed financially, and had, I understand, on the very morning of his death, a note at maturity, and without the means to cancel it.

At the trial of Dorsey the prisoner, five medical experts were examined on behalf of the prosecution. One witness testified that either wound must have caused nearly instant death; or, if the brain received the first ball, such a degree of unconsciousness would have ensued as to incapacitate the victim for inflicting the second wound.

A second witness declared that the wounds were entirely inconsistent with the idea of suicide. The three remaining witnesses testified that if not more than one minute elapsed between the shots, the case was one of homicide and not suicide. Such were the answers as given to me by the prosecuting attorney in the case.[1] Entertaining a different view from that expressed by the medical experts, Dr. William Hunt, one of the surgeons of the Pennsylvania Hospital, and myself, at the urgent solicitation of the friends of the prisoner, went to Newport on the last day of the trial. We arrived at the place in the night, expecting to go on the stand the following morning, but in the meantime the trial was brought to a sudden termination by the confession of the prisoner's wife, in which both her husband and herself were concerned in the murder; and now the question recurs, Are such wounds as described entirely inconsistent with the idea of suicide?

If the testimony given by the medical experts in the case just detailed, is to pass unchallenged, then it follows that an innocent person arrested and tried for murder in a case where a shot wound of the head and of the heart existed, might be condemned to death, even though the other evidence did not raise the connection of the prisoner with the deed, above a mere probability. In examining this question I shall assume that it is possible for a shot wound of the head and of the heart to be suicidal, and as to precedence of injury, the head or the heart, it is not essential to the case.

First, however, let us consider the subject in the order of a shot wound of the head and of the heart. There are two conditions which would disqualify an individual bent on self-destruction from inflicting the second wound in the chest, namely, the suspension or loss of consciousness and paralysis, partial or complete, of one or both upper extremities. The loss

[1] Since this paper was written I have had the pleasure of meeting one of the medical experts in this trial, Dr. Richardson, of Boston, who informed me that the evidence given by himself and others of his colleagues, as to the wounds being homicidal and not suicidal, was based upon certain facts brought out in the case which rendered the former more probable than the latter.

of consciousness, in a given shot wound of the brain, is not due to the mere passage of the missile through cerebral matter; you can thrust a finger, a trocar, or a knife, into portions of the brain, without at all affecting either sensibility or consciousness. It is due generally either to fragments of bone carried before the vulnerating body and buried in the cerebrum, to some large vessel or sinus being opened, causing a profuse hemorrhage, or to transmitted vibrations resulting from the impact of a ball against the skull, thus causing a molecular disturbance of its contents, and momentarily deranging the orderly operation of the intellect. Indeed, I believe that the sudden suspension of consciousness in many of these shot injuries of the head is due more to this contact of the missile with the cranial wall, than to its passage through the brain.

It is common to see a person fall to his knees or prone upon the ground when struck upon the head by a pebble or a fragment of a stone, but in an instant he is again on his feet, the fall does not necessarily imply loss of consciousness, though it does mean an interruption to muscular coördination. Every surgeon can recall instances of the most dreadful injury to the skull and brain without destroying the conscious volitions of the patient.

During the winter of 1885, Dr. William Hunt and myself were called to see a man who had been run over by a street-railway sweeper in the night. He was seen to rise immediately after the accident, and walk to his house on Spruce Street, two squares from the scene of injury. Opening the door with his deadlatch key, he passed up stairs to his room on the second story and went to bed. The family in the morning found him unconscious. On examination portions of the parietal and temporal bones were found driven deeply into the brain.

A prominent physician of Philadelphia was run over by an unmanageable horse, and dashed against the corner of an iron pillar, causing a frightful compound comminuted and depressed fracture of the frontal bone, tearing the membranes of the brain, and injuring its substance. I applied the trephine in two places and removed twenty-seven fragments of bone, and yet, though

unable to stand, neither motility nor consciousness was destroyed, as the patient gave intelligent instructions in reference to being carried to his home.

I recall another case of still more extensive damage to the skull; one in which, by the bursting of a fly-wheel, quite one-half of the frontal bone was carried away, and with it a considerable portion of the prefrontal lobes of the cerebrum. Only for a few moments was the man dazed, and ultimately made a good recovery.

The famous case occurring in the practice of Dr. Harlow, and figured in some of the books on surgery, is another one in point. A bar of iron having entered the face below the zygoma, passed through the skull, emerging near the vertex, without destroying personal consciousness.

A private,[1] named Solomon, Co. G., New Jersey Volunteers, received a shot-wound at the battle of Bull Run. The ball entered the skull below the tip of the left ear; the man fell, but retained his senses. The surgeon passed a probe two inches into the brain in the supposed track of the ball.

In a letter received recently from Sir William MacCormac, of London, the writer says that he thinks it entirely within the bounds of possibility for an individual, with suicidal intent, to shoot himself in the head and in the heart, or in the heart and afterward in the head, and furnishes the following cases, which render such a statement entirely feasible. The first was that of a suicidal case under the care of Mr. Hulke, where the bullet traversed the head from temple to temple, but did not emerge. The patient lived fourteen days, but did not lose his consciousness until a short time before his death, and was fully able to inflict any other wound had he been so disposed. In a second case, under the care of Dr. Smith, a bullet traversed the skull from temple to temple. The patient not only preserved his consciousness, but finally recovered.

A soldier at the battle of Pultuska, in Poland, as related by Hennen, received a remarkable wound of the brain. A ball

[1] Surgical History of the War, Part I.

carried away the bayonet of a musket, which entered the right temple of the man, two inches above the orbit, and passing backward and downward, emerged through the maxillary sinus of the left or opposite side. The soldier, aided by his two comrades, tried in vain to withdraw the weapon; the Surgeon-Major, M. Fordeau, made a similar attempt and failed, when at length the task was accomplished by a strong soldier placing the man's head on the ground and his foot upon the head, while traction was made on the missile. The patient ultimately recovered, and as it is distinctly stated that he joined his own efforts with those of his fellow soldiers in their attempts at extraction, it follows that neither consciousness nor motility was lost.

The *second* disqualifying condition for inflicting another wound after one in the head is paralysis.

The very great advance made in the last few years in regard to the functions of the brain and the topographical relations existing between the exterior of the cranium and definite cerebral convolutions, enables us to locate with considerable accuracy intracranial lesions from the symptomatic phenomena which may be present. The local areas or centres of muscular power have, for the most part, been clearly established.

It will, I think, be conceded that so long as the middle portion of the ascending frontal and corresponding portion of the ascending parietal convolutions remain uninjured, the power to use the arms is retained, and the same may be affirmed of the lower extremities, so long as the upper end of the ascending parietal convolutions and that part of the posterior parietal lobule immediately behind remain intact. The motor centres are all grouped about the fissure of Rolando, and unless a shot or other missile trenches on these special regions, motility remains; though it may, after a time, be lost by the extension of hemorrhage or from inflammatory products. So common is it to see shot and other wounds of the brain occurring without material impairment of muscular motion, that I do not think anyone will challenge the statement. Indeed, the cases already cited in support of personal consciousness after wounds of the

brain, are, most of them, equally pertinent when applied to the maintenance of motility. Nor does the fact, that a man falls, or is unable to rise after a perforating shot wound of the skull, prove that the power to use his arm is lost. The missile may damage the leg-centres and not affect the arm-centres.

Let us next change the proposition by changing the order of the wounds—the heart wound taking precedence.

The unconsciousness and loss of muscular power which follow wounds of this organ are due to hemorrhage; the vessels of the brain and other nerve centres being suddenly emptied of their blood, fatal syncope ensues; hence wounds of the heart are generally considered to be instantaneously fatal. Yet there are many, very many, exceptions to the rule. Fischer, in an analysis of 452 cases of wounds of the heart, gives no less than 35 recoveries; 72 were shot wounds, with 12 recoveries. Dr. Purple, in his collection of heart wounds, states that in 42, 12 of which were shot wounds, death did not take place immediately.

While it is true that these statistics are not altogether free from criticism, yet they possess an intrinsic value in establishing the general statement, that these injuries are not necessarily, or immediately, fatal in all instances. The following cases, culled from different sources, will go to sustain the object most needful for my present purpose. In the *Surgical History of the War*, Part I., pages 530 and 531, there is recorded the case of Private Lanning, Co. A, Pennsylvania Volunteers, who was shot in the chest, the ball entering the right auricle. The patient persisted in sitting up, and walking about his room. He lived for fourteen days.

The same author mentions the case of a private named Wright, Co. C, Fourth Regiment of the Veteran Reserve Corps, shot at Quincy, Ill., and who lived for forty-six hours. The ball passed through the lung, the left auricle, the auriculo-ventricular septum, and the left ventricle.

A private, Charles T., 1st Maryland Potomac, Home Brigade, was shot in an affray with the Provost Guard at Frederick. The

ball passed through the left ventricle and right auricle. Death did not follow for twelve hours.

In two instances given by Jamain, the patients lived six months after a shot wound of the left ventricle.

Ferrus mentions a case in which a man lived twenty days with a skewer through his heart.

Sir William McCormac writes me that Mr. Durham had a case of bayonet wound of the heart in which the patient survived fifty-six hours. The wound implicated both ventricles, the septum, and auricle, and the man walked some yards after receiving the injury.

Dr. Andrews reports a case under the care of Professor Bergman, of Dorpat, where the injured man travelled fifteen miles to Dorpat, and finally recovered.

In the *Lancet* for January, 1879, a case is reported where a man received a perforating shot wound of the left ventricle which did not prove fatal for fifty-four days, the patient having in the meantime returned to his work.

In Rankin's *Abstract of Medical Sciences*, vol. 31, page 165, Mr. Jackson reports a case of a man who received two shot wounds, one of the balls passing through the right ventricle. He lived for three and one-half hours, and was able in the meantime to make a deposition and name his assassin.[1]

A case of assassination was tried before a British court in India. A native named Kadir was shot through the heart June 2, 1873, while lying on his cot. It was stated in evidence that the victim, after receiving the fatal wound, recognized and denounced his murderer, a man named Meera Khan. On the strength of this testimony the assassin was found guilty. An appeal was made, and the case carried to another court, and the verdict reversed, on the ground that death must have been instantaneous. Mr. W. Curran, Brigade Surgeon, in commenting on this case, stated that the decision of the former court was, in his judgment, the more correct, as in his own personal experience shot wounds of the heart were not necessarily immediately fatal.

[1] Lancet, April 9, 1887, page 725.

In the *Lancet* of April 9, 1887, page 725, there is reported the case of a groom, who, while adjusting his master's foot in the stirrup, accidentally discharged a pistol which was in the holster of the saddle. The ball entered the chest, on the left side, two and a half inches to the right and one-half inch below the nipple, and pierced two chambers of the heart. He survived the injury fifty-two hours.

On May 11, 1812,[1] Mr. Percival was shot by Bellingham in the heart. At the trial Mr. Smith testified that after the firing he saw the murdered man rush hastily through the crowd toward the place where he was standing, looking first in one direction and then in the other, and, after making a few steps more, reeled and fell to the ground.

The tragically affecting case of the Duke de Berri is to the same point. While leaving the theatre in company with the Duchess, he was approached by a man, who, placing his hand on the shoulder of his victim, drew him to his side and plunged a dagger into his chest, which pierced the heart through, making a wound of some inches in length. The Duke lived until six o'clock in the morning, in the meantime begging that his assassin might be forgiven, and also speaking words of comfort to the Duchess.

I may also mention the case of a woman brought into the surgical ward of the Pennsylvania Hospital during my term of service. The left ventricle had been pierced by a butcher's knife. She survived two and three-quarters of an hour, and for at least one third of that time her mental condition was perfectly clear. Can anyone doubt that in most of the cases cited, these patients, had they been so disposed, could have inflicted a shot wound of the head?

And now, third and last, are there any instances in which a suicide has actually inflicted the two wounds which I have been considering. Dr. Macleod, Professor of Surgery in Glasgow University, Scotland, furnishes me the case of a suicide which came directly under his observation. A student shot himself in

[1] Lancet, April 2, 1887, page 674.

a water-closet; the ball entered the head. Finding that he had not accomplished the work of self-destruction, he went to his bedroom along a passage and shot himself in the heart. He lived only a few minutes after this last injury. Professor Macleod entertains no doubt in regard to the feasibility of these double wounds being self-inflicted.

In turning to the records of the Coroner's physician, Dr. Formad, I am able, through the kindness of this efficient and careful officer, to furnish the following cases:

1. A policeman shot himself first through the head; the ball, entering the right temple, was found lodged in the cranial vault on the opposite side. A second shot was fired into his chest, the bullet cutting the right side of the heart. Death from internal hemorrhage followed in about five minutes. This was done in the presence of witnesses.

2. A boy aged nineteen, inflicted four shot wounds from a revolver on his own person. The first bullet entered the forehead, and, after taking a circuitous route, lodged about the middle of the left temporal lobe. A second ball was fired into the chest, and, passing through the sternum, cut through the left ventricle of the heart, on a level with the mitral valve. A third shot passed into the abdomen, and the fourth into the neck. Death ensued from pericardial hemorrhage.

3. A grocer was found dead in his room, having locked the door. A pistol was still clutched in each hand; one bullet had passed through the brain, and a second through his heart.

4. A man committed suicide in the Park; one bullet entered the brain, and a second the chest. In all these cases the suicide was not assumed, but proven beyond a reasonable doubt.

From the foregoing facts, which are thus hastily thrown together, I think I am at liberty to draw the following conclusions:

First. That it is possible for a ball to enter the brain without destroying consciousness, though it may for a few moments cause some mental confusion.

Second. That a ball may traverse the brain without causing muscular paralysis.

Third. That a suicide may, with his own hands, if so disposed, first shoot himself in the head, and within the lapse of a minute inflict a similar wound on the heart, and there are a sufficient number of cases on record to establish the feasibility of the self-infliction of the two shots; and

Fourth. That a suicide may first discharge a ball into the chest, wounding the heart, and immediately after send a second ball into the brain.

DISCUSSION.

Dr. L. McLane Tiffany, of Baltimore.

I think that there is no possibility of gainsaying the conclusions presented by the writer of the paper. I would, however, add a fifth conclusion, that there is no possible doubt that a man may shoot himself in the heart first and afterward in the head. I have seen a patient live for a week after a wound of the heart. I have seen another case in which two cavities of the heart were involved, and there was a hole in the chest into which the thumb could be placed, and yet the patient lived nearly twenty-four hours, and was conscious.

The point made that the impact of the ball against the skull is as much the cause of the loss of consciousness as the injury to the cerebral substance, unless some particular area is involved, is a good one. There are many other points to be considered in a case of suicide beside the anatomical facts. There is the presence of powder-marks to be considered, and not here mentioned. In the case related there was a wound of the skull and a wound of the heart, and the ball seemed to have entered from the left side. A right-handed individual, in attempting to commit suicide, will, in many instances, turn the pistol toward the left. If he is a left-handed man, he will turn the muzzle in the opposite direction. The course of the ball, however, is but a small part of what has to be considered in a case of suicide. There are many things outside of the medical aspect of the case that have to be taken into consideration: the reasons that some one had for killing the individual, the reasons that the individual had for killing himself. These are matters that must be discussed, but are outside of the sphere of this paper. It is almost unheard of for a right-handed man to shoot himself in the left side of the body. I think that a good deal can be learned from the direction of the pistol wound.

I recall one case reported in *Taylor's Principles and Practice of Jurisprudence*, in which the accident was observed by the companions of the individual. A man was walking along with a double-barelled gun, both barrels cocked. A briar or something caused one barrel to be discharged, and the rebound of the gun carried it out of the hand of the sportsman, and it went back several feet, striking a stone, causing the discharge of the second barrel, shooting the man in the back, and killing him.

Dr. John B. Roberts, of Philadelphia.

I have seen only one case that has any bearing on this paper. It was that of a man who, it was alleged, had attempted suicide, and this he did not deny. He had fired two bullets at his head and one at his left side. I thought, from the position of the wound of the chest, that the ball had gone through the chest into the abdominal cavity. I called a consultation, and it was decided that it was proper to open the chest-wound and determine whether the abdominal cavity had been opened. On making an exploratory incision it was found easy to introduce the finger into the chest, and it was decided that the ball had gone upward into the lung. The man died in the course of six or eight hours, but I cannot think that the exploratory incision had anything to do with his death. It is possible the ball may have entered some of the structures about the vertebral column, or there may have been a wound of the heart. The medico-legal question, whether a man can shoot himself in the heart first and in the head afterward, I should answer in the same way as it has been answered by the reader of this paper and by Dr. Tiffany. There was a case in the Jefferson College Hospital, some years ago, if I remember correctly, of a man who lived a number of days with a wound of the heart.

The question of suture of the heart was investigated by a Dr. Block a few years ago. In a paper read before the College of Physicians of Philadelphia, I stated the conclusions of this gentleman that heart-suture was possible in the lower animals, and might be a therapeutic measure in wound of the heart in the human subject. In a case of heart-wound I would advocate opening the pericardium and doing something of this sort.

Dr. Charles B. Nancrede, of Philadelphia.

I would endorse all that Dr. Agnew has said. My experience with ball-wounds of the head would point to the same conclusions that he has reached. I can only speak positively of one wound of the heart. It occurred eighteen years ago. A policeman shot a man who was resisting arrest. The ball passed through both lungs and the heart. This patient lived quite long enough to have shot himself in half a dozen other places.

I had another case which recovered, in which I have always thought, from the position of the wound and the symptoms, that the left auricle

was injured by a pistol-ball, the case being undoubtedly one of attempted suicide. He also could have easily shot himself in the head.

Dr. E. M. Moore, of Rochester, N. Y.

My experience has been less than that of either of the gentlemen who have spoken. Dr. Agnew's paper has left nothing to discuss. The question of possibility may be considered settled. With reference to wounds of the heart, cases are numerous in which men have lived for days after such injuries. So with reference to wounds of the brain. I have seen many cases where suicide was committed with a small pistol, the ball passing into the brain, and while the patients have lived some time, so far as my recollection goes, these injuries have been attended with immediate or almost immediate loss of consciousness. I believe that the shock and general injury to the brain, resulting from the pistol ball, cause the patient to reel over, and if he continues to live for a certain period of time, it is in a condition of unconsciousness. While it is certainly possible that a man may shoot himself in the head and afterward in the heart, still it is very improbable.

Dr. Maurice H. Richardson, of Boston (by invitation).

I have had no extended personal experience in this matter, but as I was one of the experts referred to by Dr. Agnew, it may be interesting to hear some of the details of this case from the standpoint of those who gave testimony in it. Of the five who gave expert evidence, two were local physicians. The other three were Dr. Draper, Medical Examiner of Suffolk County, and Assistant Professor of Legal Medicine in Harvard University; Dr. McClellan, of Philadelphia, and myself. We were all of the opinion that the wounds described *could* have been self-inflicted, and would have endorsed the conclusions which have been presented to day. The question put to us was not whether it was *possible* that these two wounds could have been self-inflicted one after the other. If that had been asked, we should have said that it was possible, though very improbable. We were familiar with many of the cases which have been cited, and were perfectly well aware that a wound might have been self-inflicted through the heart, and afterward through the head. It did not seem so certain or so probable that the wound in the head could have been made first. There was no doubt, however, as to the possibility of this. The fact was that the second shot followed almost immediately after the first.

It seemed extremely improbable that, at the end of one, two, or even three minutes, cerebration would be perfect enough, after perforation of both hemispheres, to cause the pistol to be directed and discharged into the heart.

Another element in the case was the absence of powder-marks in the hair and scalp. One of the experts had made a special study of the effect of powder-burns on the skin and scalp, and testified very strongly that the pistol could not have been held by the murdered man without producing some marks of the powder. While we testified that, in our opinion, the case was one of homicide rather than suicide, yet we all believed that suicide was not beyond the bounds of possibility.

The night after our testimony had been given, and before the defence was opened, the accused confessed his guilt.

DR. P. S. CONNER, of Cincinnati.

Wounds of the heart are not immediately and necessarily fatal. I reported a case ten years ago, in which a ball passed through three of the four cavities, and lodged at the root of the right lung, yet the patient lived for three years and two months after the accident. He was under my care from the time of the accident until his death. I removed the specimens, and presented them to the Cincinnati Academy of Medicine, and reported this case in the Cincinnati *Lancet and Observer*, a report which has not been much referred to, perhaps, for the reason that its truth was questioned. The ball struck on the right side, knocking off a small piece of bone, which lodged in the lung. It then passed along the pleura, struck the sternum, was deflected, went through three of the cavities of the heart, and lodged at the root of the right lung. That such a course was possible, I demonstrated with my friend, the late Dr. Longworth, by numerous experiments upon the dead body. It is easy to drive a small ball or a sharpened wire through three of the four, or even the four cavities of the heart, and have it stop at the root of the right lung. The heart-murmurs in the case referred to, during the years subsequent to the injury, were extraordinary.

DR. R. A. KINLOCH, of Charleston, S. C.

I will relate the history of a case in which it was a question between suicide and accidental shooting. An individual was killed by a shot in the head. It was claimed that he had been cleaning the pistol, and

that it had been accidentally discharged. I was called to examine the case. The man had a full beard, and the shot had entered under the neck. I found, on carefully separating the beard, that the hair had been burned, and that the skin under the beard had been burned. The pistol had evidently been held close to the head, and the case was one of suicide.

Dr. J. E. Michael, of Baltimore.

I will mention one case of interest in this connection. It is that of a man aged forty years, who was shot on the evening of Christmas, 1885. The post-mortem examination showed that the ball had passed through the cavity of the left ventricle. This man lived twenty hours after the accident, and was in such a condition that he could have inflicted another wound upon himself.

Dr. David W. Yandell, of Louisville.

A man stabbed another in the heart. The injured man chased his assailant one hundred and fifty feet, struck him, nearly killed him, fell and died in an instant. A man standing behind the counter in his store, was shot in the left ventricle. He ran around the counter, a distance of twenty feet, hit the man who had shot him on the head with a hammer, and killed him by the blow. My buggy-boy, aged fourteen, went to sleep while sitting in the buggy, and dropped the reins. In endeavoring to catch them he fell under the horse's feet, and had a large portion of the vertex of his skull kicked in. He jumped up, walked a hundred and fifty feet, and sat down in the kitchen. He remained sitting and chatting until he saw me approaching, when he fell in a faint. I removed six or eight pieces of bone. He recovered without a bad symptom.

Dr. T. F. Prewitt, of St. Louis.

I recall two cases. One was that of a man who first shot his wife and then shot himself. The ball entered the left frontal bone, and went back into the brain. There was no loss of consciousness. When brought to the hospital he was perfectly rational. He did not complain of anything. He died, a year after the accident, from abscess of the brain, the ball being found in the bottom of the abscess, in the frontal lobe, near the fissure of Sylvius.

A few months ago, a boy eight or nine years of age found an old pistol in a trunk, and in playing with it he put it to his head and

fired. The ball entered the skull above the ear, in the left parietal bone. I was sent for, and found that the physician first called was in doubt whether the ball had entered the brain or not. I introduced the probe, and found that the ball had passed through the bone, and a small portion of brain-matter came away. The boy had not lost consciousness for a moment. He has been well ever since, and has not exhibited the slightest bad symptom. I recall the account of a deer having been killed, and a ball found imbedded in its heart.

Dr. T. R. Varick, of Jersey City, N. J.

The question of burning of the part with gunpowder has been alluded to as bearing on the proximity of the weapon, and upon the question whether the wound was suicidal or homicidal. I am reminded in this connection of a case in which I was a witness. A young man was indicted on the charge of murder, for shooting a fellow schoolmate. One witness swore that she saw the parties grapple and fall, and that the defendant got up with his left hand on the shoulder of the one killed, and with a pistol in his right hand, fired and killed the man. On the part of the defendant, it was claimed that in the scuffle the pistol was accidentally discharged, and that the ball struck the pavement. The question was whether the man had been killed by a direct shot or a glancing ball. The question as to the position of the parties at the time of the shooting was raised. It was averred that at the time of the shooting the pistol was not more than four inches from the party's head. In order to settle this point, I made some experiments with a pistol, shooting at some sheets of paper. I found that up to a distance of two and a half feet there was a perceptible marking with the powder, increasing in intensity as the pistol was approximated to the paper. It was proven that there were no marks of powder on the victim's head. The ball entered through the squamous portion of the temporal bone, above the zygoma, which is about the thinnest portion of the skull. The ball was flattened, and was found in the left hemisphere, on a plane above the point of entrance, showing that it had passed from below upward. As I have said, the ball was flattened, as though it had struck some hard substance. It could not be made to enter the barrel from which it had been discharged. In the memorable case of Dr. Lutener, who was shot through the occipital protuberance, the ball was scarcely at all marked. The absence of powder-marks negatived the testimony of the lady, and this, with the damaged condition of the ball, and the direction in which it had entered the skull, acquitted the defendant.

COMPARISON BETWEEN THE SURGICAL DISEASES OF THE WHITE AND COLORED RACES.

By LOUIS McLANE TIFFANY, M.D.,
PROFESSOR OF SURGERY IN THE UNIVERSITY OF MARYLAND.

THE following notes are brought to the attention of the Association as preliminary to a more extended series of observations not yet completed.

While the number of cases collected is too limited to admit of the formulating of rules for a comparison between surgical affections of the white and colored races, yet it will suggest lines of thought for future research.

The statistics presented are prepared from a record extending over a period of thirty-four months, embracing 4930 surgical cases, the great majority being out-door patients of a general hospital, the minority occupying beds in the wards of the same hospital; so far as possible, all patients were studied under similar conditions. Of the 4930, 64 per cent. were whites, and 36 per cent. were negroes. Under this latter heading are classed mulattoes of various shades. Not the least interesting observation that I have made, is that where whites and black negroes differ in their behavior under a disease, mulattoes are apt to occupy a middle position, corresponding more or less to their gradation of color. The diseases of the two races will be compared in percentages, and it is necessary to remember the proportion already stated which the whites bore to negroes—64 : 36, or nearly two to one.

	Whites.	Negroes
Abscess occurred in	57 per cent.	43 per cent.

the negro slightly exceeding his proper percentage; when, however, abscess by region is studied, a marked difference is found.

	Whites.	Negroes.
Abscess of neck and axilla	44 per cent.	56 per cent.
Abscess of hand and fingers	75 "	25 "
Alveolar abscess	45 "	55 "

Alveolar abscess was observed very rarely in the dark negro, but frequently in the light mulatto.

The neck and axillary abscesses were often observed in association with enlarged lymphatic glands, and examination showed enlarged lymphatic glands in

	Whites.	Negroes.
Neck, Axilla, Groin	41 per cent.	59 per cent.

Excessive pus formation occurs in the negro, not only with scrofulous affections, but with syphilitic, as well; enlargements of lymphatic glands also are apt to be marked in the syphilitic negro, compared with the white race. My experience leads me decidedly to the opinion that suppuration in the syphilitic negro is greater than in the syphilitic white.

The following table indicates the relative frequency of the diseases named:

	Whites.	Negroes.
Ganglion	83 per cent.	17 per cent.
Bursa	77 "	23 "
Hydrocele	94 "	6 "
Fistula in ano	71 "	29 "

In the negro this latter has rarely been noted, unless accompanied by indications of tuberculosis.

	Whites.	Negroes.
Internal hemorrhoids	82 per cent.	18 per cent.

It is not at all uncommon for "piles" to be complained of by negroes, who are apt to designate all rectal and anal discomforts by this name. Examination, however, often reveals another pathological condition; the above percentages are accurate.

	Whites.	Negroes.
Spinal caries	47 per cent.	53 per cent.

has been seen in the lower dorsal region of the negro more often than elsewhere. Recovery from caries of the spine is more frequent among whites. An adult or middle-aged negro

KELOID IN THE NEGRO.

showing the characteristic humpback of cured Pott's disease is a great rarity.

Dislocations have been encountered more often in the whites, and taking the shoulder as a standard, the proportion is found to be—white, 82 per cent.; negro, 18 per cent. Fractures do not show a difference between the races.

Keloid is very common among negroes, and rare among whites. Its occurrence without wound is a matter about which I have been able to reach no conclusion, since a traumatism so slight as to have been forgotten, may be the starting-point. In at least one instance (negro) within my personal knowledge, a keloid formed at the seat of an injury, the skin not having been broken. The tendency to keloid growths is most pronounced in early life, less so in adult, while it is highly probable that middle and old age are accompanied by a tendency on the part of the formations in question to cease growing and atrophy. Hence, an aged negro with keloid is exceptionally seen. Retrograde metamorphosis is characterized by the surface becoming soft and wrinkled, resembling somewhat the pendulous tumor of fibroma molluscum. Removal of keloid in early life is to be deprecated, speedy recurrence being inevitable; when the period of rapid growth has passed an operation can be undertaken with the prospect of relieving the patient from a present discomfort, and the expectation of a limited recurrence, if at all. Of benign tumors, lipoma and fibroma are recorded as met with more often in the colored race; sebaceous cysts occur largely in whites—88 per cent. Telangiectatic formations are extremely rare among negroes; their non-recognition may be due in some instances to their being obscured by skin pigment, in the same way that an erythema or commencing erysipelas may escape notice, but this will not hold good for the tuberous nævi so common in white children.

Of malignant growths, the ones most common in the negro are the sarcomata, and these are usually in relation with the skeleton (osteo-sarcoma). Carcinoma is very rare in the negro. A most interesting observation in this relation is that there is not recorded a single instance of epithelioma of the face or lip of a negro. My practice, other than here tabulated, shows

similar experience. On one occasion only can I recall to mind an instance of epithelioma of the tongue of a negro.

Acute inflammatory gonorrhœa is recorded as more frequent in whites, while the reverse is true of chronic urethral discharge, negroes not paying much attention to such a trifling ailment. Gonorrhœal rheumatism is infrequent in the colored race.

Inflammatory phimosis, usually from local sores (chancroidal) occurred in the proportion of white—27 per cent.; negro, 73 per cent. The sores are very often situated just inside the preputial orifice.

Lateral curvature of the spine is very rare in the negro; on the other hand, rickets, with more or less bone deformity, occurs—white, 37 per cent.; negro, 63 per cent. Congenital deformities are very exceptionally seen in the colored race, and, if present, the possessor will probably be a light mulatto.

Cleft palate, harelip, talipes (non-paralytic), exstrophy of bladder, epispadias, hypospadias, spina bifida, have not been met with in the dark negro.

One instance of spina bifida, one instance of harelip, and two instances of congenital club-foot have been met with in negroes having a very large admixture of white blood.

Comparison made between ward patients of the two races, some admitted into hospital when first seen, others treated as out-patients, and sent into hospital for operation, have led me largely to form the opinions expressed in suggestions 1 and 2, hereunto appended.

In conclusion, I offer the following suggestions:

1. Surgical affections pursue different courses in the white and colored races under identical hygienic surroundings.

2. Surgical injuries and operations are better borne by negroes than whites.

3. Surgical diseases involving the lymphatic system, especially if tubercular, are more fatal in negroes than in whites.

4. Congenital deformities are more rare in negroes than in whites.

5. Surgical differences observed between whites and negroes are due to race peculiarities.

DISCUSSION.

Dr. C. Johnston, of Baltimore.

I regard as a very happy one the idea of contrasting and comparing constitutional tendencies in the white and colored races after surgical operations, as well as the proneness of certain pathological states or diseases to be selective as between the races. Dr. Tiffany has the merit of formulizing facts which have always commanded the attention of surgeons, but which have now acquired a new value by reason of their co-relation, harmoniously or antithetically. The basis of his observations is certainly a wide one, namely, the surgical cases met with in 29,000 dispensary applicants of all kinds; and having worked in the same field, I have confidence in asserting myself in accord with most of the inferences drawn by my eminent colleague.

Without producing statistics, I may say that, so far as my experience has gone, there are individual, as well as ethnological peculiarities, but in general those which distinguish colored subjects are most striking in proportion to pureness of blood. This remark applies to tubercular infection, quite decidedly, for, as Dr. Tiffany justly observes, while the dark negro is less disposed to tuberculosis and tubercular infection than the Caucasian, I am of opinion that, as the color fades out, the tubercular tendency grows apace. Thus, strumous ulcers and abscesses, as about the neck, would seem to follow the rule laid down above, and to point to a greater frequency in the mulatto than in the white.

I have always regarded the negro as a favorable subject for surgical operation, both on account of his stolid courage after having accepted operation, and the moderate constitutional disturbance produced by surgery. I am much inclined to agree with Dr. Tiffany, that the negro suffers less reaction than the white, and, apart from the immunity conferred in general by modern antiseptic treatment of wounds, the traumatic fever of the former is, perhaps, less intense.

With regard to some other points I find it difficult to compare the two races; thus, I have never met with carbuncle in the negro, and I do not remember having seen cleft palate or harelip in the darker individuals. Epithelioma I have infrequently encountered; my first amputation, however, of the penis was upon a colored man, but one of rather light shade. Osteosarcoma I have seen, although, perhaps, rarely; but lipomas, as I am sure that all who have practised surgery

in communities composed in part of the colored race are aware, are common enough; and fibromas, abdominal and other, are quite as frequent as in the white race—doubtless, more so.

Finally, I would emphasize the proneness to the development of keloid in the negro, and, of course, do not differ herein from my colleague. Indeed, I regard the occurrence of keloid as characteristically frequent in the negro, and, of course, in a figure greatly preponderating over the white race. I have seen it in the former largely developed over the chest, and rest of the trunk, the face and limbs, sometimes, perhaps, spontaneously, but mostly as a consequence of pressure, friction, or traumatism; but I have not nearly so many such experiences with the Caucasian..

To sum up, therefore, I have found that in the negro the skin and white tissues are more frequently the seat of certain disease than those same tissues in his fairer brother, and I take pleasure in echoing in general the views of Dr. Tiffany.

Dr. T. G. Richardson, of New Orleans.

I will briefly run over some statistics which I have put down on paper. They will be of some interest, especially as they do not carry out fully the conclusions of Dr. Tiffany. They are the statistics of patients in the hospital; we have no record of the out-patients. Their number is so great that we simply prescribe for them and let them come on a ticket.

During the past five years we have admitted to the hospital 3662 patients, of whom 2809 were white, and 853 were negroes.

	White.	Negro.	Total.
Abscess	187	96	283
Erysipelas	177	49	226
Cancer (using the term in its general acceptation)	140	69	209
Epithelioma	83	30	113
Traumatic tetanus	27	15	42
Epilepsy	135	46	181
Aneurism, internal and external	112	29	141
Hemorrhoids, internal	66	8	74
Fistula in ano	75	22	97
Stricture of the urethra	123	85	208
Disease of the bladder in general, cystitis, etc.	86	35	121
Coxalgia	38	10	48
Cutaneous diseases in general	181	41	222

It will be noticed that I have said nothing about syphilis, for the simple reason that I cannot present statistics that are worth anything. We have a ward for syphilitic white patients, but we have none for syphilitic colored patients, as they are nearly always treated at their homes. As I have limited myself to hospital patients, I could not embrace those treated outside.

I should like to confirm the conclusions of Drs. Tiffany and Johnston with reference to congenital deformities. It is rare to find a congenital deformity in the negro.

DR. E. H. GREGORY, of St. Louis.

The time which I could devote to a consideration of this subject was very limited. I consider it a very important and interesting subject, and we are indebted to Dr. Tiffany for introducing it. There must be a great difference between the two races. The most striking peculiarity that I noticed in the reading of the paper is the fact that pus is very common in negroes—so common, that it is found associated with syphilis. This strikes me as rather extraordinary. My experience may not correspond with that of others, but I have rarely seen pus in connection with syphilis. It seems to me that the formation of pus in the manifestations of syphilis is exceptional. I have never regarded a suppurating venereal sore as a typical chancre. Where I have seen a suppurating syphilitic trouble, primary in character, I have been disposed to believe it a local infection rather than the associate of a constitutional condition, and have given the patient reason to hope that secondary manifestations would not appear.

I can confirm the statements of Dr. Tiffany with reference to keloid. The most extraordinary manifestations of this affection that have come under my observation have been in the negro. I have seen more tumors of this character on the negro at one time than I have in the white. In fact, I have never seen multiple keloid in the white race. In the negro it is common to have a number of these tumors.

Another point which struck me is the statement that these tumors may possibly be removed more hopefully in the aged than in the young. I have made it a rule never to touch a keloid. I have sometimes referred them to those who practise electrolysis, and I have expected something from this agency. My observation with keloid has been that in the white man they attain a certain size and cease to

grow, and not infrequently they contract. I have felt that I was justified in advising individuals that they should not be touched.

The statistics of Dr. Richardson and those of Dr. Tiffany differ in some respects. The inference to be drawn from Dr. Tiffany's paper is that the resistance of the negro is below that of the white man, that his is not a standard organization as compared with the white. To my mind, pus always implies infection. If it be a fact that the negro is more apt to produce pus than the white man, it follows that his resistance to the agencies of infection is less than that of the white man. Whether it is true or not, I accept the idea because it is convenient, that all suppuration of a strumous character is due to a microbe. I assume this, and I believe that it is only the weakest possible body that entertains the tubercle bacillus, regarding it as the weakest of all infective organisms, and the body that entertains that bacillus represents the lowest possible degree of organization, that it is at the bottom of the scale. This is my way of thinking of the matter.

It strikes me that such an assumption is irreconcilable with the observation, I believe, of both Dr. Tiffany and Dr. Johnson, that negroes do better after injury than do white men. It seems to me that the reparative processes are always proportional to the energy and perfection of the body, and that when we are low in the scale of organization our reparative processes are relatively feeble. If the negro has better plastic processes than the white man, I can scarcely reconcile it with the statement that he has more tubercle, and is more ready in the production of pus than the white man.

I can understand that the negro may have a greater indifference to disease, and may be harder to convince that he is ill than the white. I have noticed that when I have a white patient who is insensitive to disorders, he yields less, and is, therefore, more courageous; whereas, if I have a patient who is morbidly sensitive, he yields readily. The indifference of the negro may play some part here. The negro cannot enter fully into the conception of a surgical operation, and in this way we may account in part for his indifference to operations, and perhaps in some measure for the fact that he gets well after operations quicker and better than the white man. It seems to me that the fact that a body produces pus readily is irreconcilable with the assumption that the plastic processes can be up to the standard.

I have never seen cancer of the lower lip in the negro. I have never seen ganglion in the negro. This is very common in the white

race, and there is scarcely a month passes in which I do not see a number of these in the white race, but I cannot call to mind a single example in the negro. After I had received the notice that I was expected to speak on this subject, I went to the City Hospital of St. Louis, and I found that the statistics kept showed that negroes bear operations about as well as the whites, but, from what I could learn, the negro has no advantages in this respect. I also learned that the negro is tubercular. This seems to be the commonly accepted idea. Mulattoes are more disposed to tubercle than are the blacker races. The inference is that, as a rule, negroes should make the worst surgical subjects.

Dr. William T. Briggs, of Nashville, Tenn.

I have no statistics bearing on this subject, and have but a word with reference to my experience, which is drawn almost entirely from hospital practice. My observation confirms the suggestions made by Dr. Tiffany. The negroes in our city live in low places, in small cabins, very much crowded—sometimes as many as a dozen persons in a room. They live on the cheaper articles of food, and usually eat enormously. Consequently, it is not astonishing that they have a lower degree of vitality than the white race, and that they are subject to scrofula. Almost all negroes are scrofulous. It is the rare exception to find a negro who has not the scrofulous diathesis. It crops out on all occasions. On account of their lower vitality, they are more subject to suppuration. Suppuration occurs from the slightest causes. Almost any irritation will run into suppuration. Almost every operation, notwithstanding complete antiseptic precautions, will, sooner or later, present suppurative action. These suppurations are sometimes long continued and excessive.

I think, probably that negroes bear operations better than the whites. This is possibly because they have no idea of the magnitude of the operation, or of its danger, nor do they care much as to the result. They have a good place in the hospital, and would rather stay there than anywhere else—they are not in a hurry to get out. They usually react well after operations, and have less fever—the temperature hardly ever rises high, but that they recover as well as the whites I do not think is true. I think their convalescence is more prolonged—it takes longer for the wounds to heal. Still, there is no great difference in that respect, the only difference being produced by peculiarity of constitution.

While I believe that malformations are much less frequent in the negro than in the white, yet I have met with all kinds of malformations in the negro. I have seen at least half a dozen cases of club-foot in the negro. I have operated on the blackest negro that could be found for harelip, complicated with cleft palate. I have not met with many of these cases, however. Spina bifida I have seen on several occasions, but I think it is less frequent in the negro than in the white.

Hydrocele was mentioned as a rare affection. The first hydrocele on which I ever operated was in a negro. In this case the tumor reached to the knee. I see this affection not infrequently. Scarcely a winter passes in which I do not have in the clinic a case of hydrocele in the negro. There is one fact bearing on this condition, and that is, that negroes are not particularly careful with their sexual organs, and if the hydrocele does not get in their way, they pay but little attention to it.

In regard to keloid, I agree that this is of very common occurrence. It is very hard to relieve; remove them, and they come back twice as large. They are more frequent on the ear than on other portions of the body, but I have seen them on every part. In regard to the other diseases mentioned, I agree almost entirely with the author. Cancerous affections, I think, are not so common in the negro as in the white race. I do not recollect ever seeing a case of cancer of the lip. It is frequently seen upon the penis. Cancerous diseases of the breast are not infrequent, but probably not so common as in the white race. Abdominal fibroids are very common, and the greater number of abdominal tumors in the negro belong to the fibroid, or fibro-cellular variety. I have been asked if I ever saw a pure ovarian tumor in a negro. I have had one case of a regular ovarian tumor weighing one hundred pounds. This was probably the second case that I have seen in the negro. As I have said, the great majority of abdominal tumors in the negro are fibroid, or fibro-cystic, and are nearly always connected with the womb.

With the other conclusions of Dr. Tiffany I fully agree.

Dr. David W. Yandell, of Louisville, Ky.

I have no statistics to offer upon this subject, but I have listened with exceeding interest to the excellent paper, and to the remarks of the gentlemen who have preceded me. I agree, in the main, with the last

speaker, although my experience has been somewhat different on certain points. I never saw a case of keloid in the white race. I have seen many in the negro. I have seen but two cases of hydrocele in the negro; this, I think, is explained by the remark of Dr. Briggs. I agree with Dr. Briggs in reference to the tendency to suppuration in the negro. I find that it often follows even when every precaution is taken to prevent it. I think that negroes bear operations well, but convalesce slowly. Whether this is due to the fact that they are comfortable in hospital or not, I cannot say, but I think it a fact that they recover from traumatism slowly.

I have never seen harelip in the negro, and but two cases of club-foot. One was in the service of my friend from New Orleans, when he was connected with the University of Louisville. I have seen but two ovarian tumors in the black race, and never an epithelioma on the face of a negro. I have, however, occasionally seen it on the penis. Epilepsy is exceedingly rare among negroes. I have rarely seen tetanus among the blacks. I have never seen internal hemorrhoids in the negro, and have met with but two instances of fistula in ano. Livingstone, in his book of travels in Africa, I am told by the President, reports no hemorrhoids and no dyspepsia among the native Africans. I think dyspepsia is exceedingly rare among negroes; they are given by nature great food-consuming capacity, and are usually ready and able to eat anything, and digest everything set before them. I find stricture of the urethra exceedingly common among negroes.

Dr. R. A. Kinloch, of Charleston, S. C.

I shall refer to only two points. The first is with reference to the tendency to suppuration, and the second is in regard to the ability of negroes to stand operations. I think a mistake is made in classing all negroes together. It is well to separate the pure negro from the hybrids and mulattos. The mulatto is a hybrid, and in all hybrids the powers of resistance are low. I disagree with some of my friends in reference to the tendency to suppurative inflammation in the pure negro. I think that it is less than in the white. I think that I am borne out in this by the fact that if we look upon the negro as an inferior in the scale, it seems natural that such should be the case. As we descend the scale we find less tendency to suppuration. I do not think that, as a rule, the pure negro is strumous. I do not think that he is affected to the same extent by syphilitic poison. Suppurative inflammation and

the secondary and tertiary symptoms I have not seen to the same extent in the negro as in the white. The mulatto, on the other hand, is almost always strumous. We see him with enlarged glands in the neck, in the axilla and groins, and, when syphilis attacks a mulatto, it, as a rule, never ends, but becomes mixed up with struma, so that it is difficult to decide whether or not you are treating a syphilitic case proper.

I think that the pure negro bears operations well and recovers promptly. This is, in part, connected with the peculiarity of his nervous system, associated with his lower scale of being. He is more apathetic. As Dr. Briggs has said, he is indifferent to operations. We have not to contend with the depressing influences of the nervous system.

While what has been said as to the way in which negroes live, is true, yet they live on good, wholesome food, and take plenty of it; they are active, and out of doors. A large number of them are athletic, with well-developed muscles, and, with these peculiarities, they bear operations well, and recover promptly, without suppurative inflammation. The mulatto speedily succumbs to shock; it is with difficulty that suppuration is prevented in him, and he is a long time in recovering from the graver operations.

Dr. A. Vanderveer, of Albany, N. Y.

Coming from a Northern State, my experience with negroes is limited, but, in connection with the Albany Penitentiary, I have made some observations. During the past fifteen or twenty years we have had a large number of negro prisoners sent there from the South. The vast majority of these die of tuberculosis of some form. Many of those who come have soft chancres in a suppurating condition. They have also suppurating buboes. In cases where the chancre takes in a large quantity of connective tissue, there is no attempt to heal, and I have had a great deal of trouble with abscesses and sinuses. When they get a true Hunterian chancre, they present the identical bullet bubo seen in the white race.

In connection with the gonorrhœa, a large proportion of these cases present stricture, and are thoroughly indifferent. We have a greater number of perineal abscesses and sinuses among the blacks than among the whites. If an operation is done for the relief of the stricture, the negro is less apt to suffer from urethral fever.

DR. TIFFANY. The experience of those who have had more opportunities than I have had agrees, in the main, with what I have said. The statistics which I have brought forward are actual. The question of fibroid and other tumors of the belly would naturally come up for discussion, but, as these have not come under observation in the out-department of the hospital from which my figures were obtained, they have not been included. With reference to what has been said about the pure negro and the mulatto, it is to be remembered that the pure negro is a rare individual. I have seen very few. Very many colored individuals have more or less white blood. According to my observation, the most marked peculiarity between the pure negro and the mulatto is shown in the teeth. The skeleton of the pure negro shows good teeth, while the mulatto loses his teeth early. I have frequently seen edentulous mulattoes not over twenty years of age.

As in laboratory work, it is a question of soil, as to whether potato, gelatin, or boullion is going to grow best certain infecting organisms of one kind or another; so can we learn by observation whether the white, dark, yellow, or red race is the best culture medium for certain infecting principles. The statistics which have been given are of a certain amount of interest, but this subject can only be studied by looking at the different individuals as so many laboratory culture media.

AN EXPERIMENTAL STUDY OF THE EFFECTS OF PUNCTURE OF THE HEART IN CASES OF CHLOROFORM NARCOSIS.

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THERE has been, already, considerable written on cardicentesis, although the operation was originally proposed and performed in 1882, by Dr. B. F. Westbrook, of Brooklyn, N. Y. Prior to this date several unintentional punctures of the heart had been made without being followed by unfavorable results.

Dr. John B. Roberts reported two cases of this kind at a stated meeting of the College of Physicians of Philadelphia, January 23, 1883.[1] He likewise called attention to the fact that[2] "Cloquet, Bouchut, Legros and Onimus have also observed the apparent innocuousness of wounds of the heart made with capillary trocars. Steiner found, ten years or more ago, that electro-puncture needles could be quite safely introduced into either ventricle, provided they were at once withdrawn."

Dr. F. M. Corwin reports in detail a case in which a puncture was made in the right ventricle, about one inch from its apex, without giving rise to any unfavorable symptoms.[3] Dr. C. L. Dana has reported two cases[4] in which punctures of the right ventricle were made with negative results. The reports in both these cases are so meagre as to diminish greatly the value which they would otherwise possess; but the comments on cardicentesis are unquestionably highly valuable.

[1] The Medical News, vol. 42, p. 45. [2] Ibid.
[3] The New York Medical Record, vol. 23, p. 263.
[4] Loc. cit., vol. 23, p. 140.

Having referred briefly to the literature of cardicentesis, which possesses an important bearing on our subject, although we believe this operation has never been performed on the human subject for the relief of chloroform narcosis, we will now briefly state the observation which prompted us to make these experiments.

While working in my laboratory, with my assistant, on the evening of February 20, 1887, I killed, with chloroform, a bulldog, which weighed forty-one pounds; and about four minutes after the cessation of respiration made an incision from the base of the neck in the median line to the symphysis pubis. This incision was promptly carried completely through the walls of the thorax and abdomen—thus exposing the heart, lungs, intestines, etc. The heart was observed to be entirely motionless and in full diastole, while the lungs were completely collapsed and lying in the posterior portion of the thoracic cavity, in close proximity to the vertebral column. My assistant, at this moment, seized the heart between his thumb and fingers, when the cardiac action was immediately resumed and the hand was removed.

The contractions promptly became full and regular, and during the first two minutes the pulsations were about sixty per minute, while during the succeeding minutes they became irregular and stopped at the end of this period, but only to be stimulated into action by the second touch—action continuing two minutes—and was the third time started up in the same manner, but this time continued to beat only one-half minute and could not again be roused into action.

The lungs during this whole period remained completely motionless and there were no other indications of life.

These observations suggested to me the possibility of arousing the heart into action, even after the entire cessation of its movements, by the introduction of a needle into this organ. The following record shows the result of our experiments:

Experiment I.—Mongrel, male, aged one year, weighed twenty-four pounds. Dog narcotized with chloroform. The puncture was made in the fifth intercostal space, one minute after the cessation of the heart's action. Three seconds after the needle penetrated the heart it

began to beat regularly at the rate of 120 per minute, which continued about twenty seconds and then became gradually slower and more feeble until it finally ceased pulsating, after one minute and a half. The puncture was made in the left ventricle about midway between the base and the apex.

EXPERIMENT II.—Mongrel, female, aged two years, weighed sixteen pounds. Dog narcotized with chloroform. The puncture was made with a medium sized aspirator needle in the fifth intercostal space, one minute after the cessation of the heart's action. The heart responded promptly to the puncture and continued to beat two minutes. The needle entered the septum ventriculorum midway between the base and the apex.

EXPERIMENT III.—Terrier, female, aged two years, weighed eleven pounds. Dog narcotized with chloroform. The puncture was made in the fourth intercostal space, one minute after the cessation of the heart's action. The heart began to pulsate after a few seconds, as was indicated by the movements of the needle. The pulsations finally ceased after one-half minute. The needle had penetrated the left ventricle near its base.

EXPERIMENT IV.—Scotch terrier, male, aged one year, weighed fifteen and three-quarters pounds. Dog narcotized with chloroform. Puncture made one minute after the cessation of the heart's action. The needle entered the right ventricle near its base and very close to the septum ventriculorum. The aperture in the needle was occluded and there was no escape of blood through it. The response to the puncture was prompt, although the pulsations, at first, were very feeble, but they gradually became stronger. Two minutes and a half after the puncture was made, this dog began to breathe without having received any assistance. Respiration continued two minutes. The pulsations ceased seven minutes and a half after the puncture was made. The needle was allowed to remain in the heart until after the thorax was opened.

EXPERIMENT V.—Mongrel, male, aged two years, weighed twenty-seven pounds. Dog narcotized with chloroform. The puncture was made one minute after the cessation of the heart's action, in the fifth intercostal space to the right of the mesian line, with a small aspirator

needle, which entered the right ventricle. The responsive action of the heart was at first tardy and feeble, but became gradually strong and regular. After the lapse of two minutes the dog commenced a gasping respiration, which steadily improved until the animal fully recovered. No other efforts were made favorable to resuscitation except the puncture. The post-mortem examination revealed the presence of a very small quantity of blood within the pericardial sac.

Experiment VI.—Scotch terrier, female, aged three years, weighed fifteen pounds. Dog narcotized with chloroform, which was removed from the animal's nostrils immediately after the heart was punctured. The puncture was made with a small aspirator needle in the fifth intercostal space, a little to the left of the mesian line, one minute and a half after the cessation of the heart's action and a little more than a half minute after the stoppage of respiration. The needle entered the left ventricle. The responsive action of the heart was prompt and continued three minutes and a half. No additional efforts were made for resuscitation. The post-mortem examination revealed the presence of a small amount of blood within the pericardial sac.

Experiment VII.—Mongrel, male, aged eight months, weighed sixteen pounds. The puncture was made with a medium sized aspirator needle in the fifth intercostal space, a little to the left of the mesian line and entered the left ventricle about half an inch above the apex. The puncture was made one minute after the cessation of the heart's action, and half a minute after the stoppage of respiration. The heart promptly resumed its action, as shown by the movement of the needle. There was found a small quantity of blood within the pericardium.

Experiment VIII.—Terrier, male, aged five years, weighed eleven and a half pounds. Dog narcotized with chloroform. Respirations stopped about half a minute after the cessation of the heart's action. Two minutes after the stoppage of pulsations the heart was punctured, when it again resumed its functions. This resumption was, however, feeble and continued only fifteen seconds.

Experiment IX.—Mongrel, female, aged one year, weighed twelve and one-half pounds. Dog narcotized with chloroform. Heart punctured two minutes after the cessation of its action. The entrance of the needle into this organ was indicated, within a few seconds,

by its movements, which continued feebly two minutes and then ceased. There was no escape of blood through the needle. There was a slight effort made to assist in the restoration of this animal by keeping up artificial respiration. The post-mortem examination showed that the needle had entered the left ventricle near its base. The lungs were found to be extensively inflamed.

EXPERIMENT X.—Mongrel, male, aged one year, weighed twenty pounds. Dog narcotized by chloroform. Heart punctured with a medium-sized aspirator needle, which entered near the centre of the right auricle. This puncture was made one minute and a half after the cessation of the heart's action, and one minute after the stoppage of respiration. The pulsations of the heart then became strong and regular after a few seconds, and so continued about three minutes; but soon after the lapse of this period the movements of the needle indicated that it was beating tumultuously, which continued several seconds, when its action became very feeble and irregular. There had been no attempt at respiration at the end of this period. The chloroform had been removed as soon as the puncture was made. The tongue had been promptly drawn forward sufficiently to prevent its obstructing the entrance of air into the lungs. No other efforts were made for the resuscitation of the animal until the movements of the needle had become almost imperceptible, when artificial respiration was resorted to with the most beneficial results, the pulsations of the heart becoming gradually stronger and more regular. The artificial respiration having been continued two minutes, the dog was then in a condition to go on to a permanent recovery without further assistance. This dog fully recovered. Fifteen minutes had already been occupied in this experiment since the heart was first punctured. The chloroform was now reapplied and respiration ceased after one minute, but the heart continued to pulsate four minutes.

During the whole period the drug had been so employed as to prevent the inhalation of all atmospheric air. One minute after the cessation of the heart's action the chloroform was again removed and a renewed effort was made for the resuscitation of the animal—which only succeeded so far as to excite a very feeble cardiac pulsation. The second efforts made for the resuscitation were the same as those which have already been mentioned as being made in the first. The needle had been allowed to remain in the heart during the whole period of our experimentation.

Experiment XI.—Mongrel, female, aged one year, weighed forty-one pounds. The heart was punctured with a medium-sized aspirator needle, two minutes after the cessation of its action, and one minute and a half after the cessation of respiration. The heart responded promptly, but rather feebly, and continued to beat three minutes. There was no attempt made at respiration and no effort at restoration except the puncture. The needle entered the left ventricle.

Experiment XII.—Skye terrier, female, aged one year, weighed fifteen and one-half pounds. Dog narcotized with chloroform. The heart was punctured one minute and a half after the cessation of its action, and one minute after the stoppage of respiration. The heart resumed its pulsation about three seconds after it was punctured by the needle. It was feeble at first, but gradually became stronger. After a lapse of two minutes, the tongue having been drawn forward, the dog began to breathe; although there had been no assistance rendered other than what has already been mentioned. The dog continued to breathe about two minutes, while the heart pulsated for fully five minutes. The cavity of the right ventricle had been punctured and the escape of blood through the needle was more than an ounce.

Experiment XIII.—Mongrel, female, aged four years, weighed twenty-seven pounds. Dog narcotized with chloroform. The puncture was made through the fourth intercostal space one minute after the cessation of the heart's action, when, after the lapse of a few seconds, the heart responded very feebly and continued to pulsate only half a minute. The needle entered the right auricle.

Experiment XIV.—Mongrel, male, aged two years, weighed seventeen pounds. Dog narcotized with chloroform. The puncture was made in the fifth intercostal space one minute after the cessation of the heart's action. The pulsations of the heart became clearly perceptible within a few seconds. The heart was soon pulsating strongly and regularly, while every impulse forced out of the needle a jet of blood, which was allowed to continue about two minutes, and was then stopped by plugging the lumen of the needle. The animal had already lost fully an ounce and a half of blood. Prior to the arrest of the hemorrhage the dog had resumed breathing, although entirely unaided beyond the puncture. He steadily improved, and,

after the lapse of about twenty minutes, the needle was withdrawn, and the dog allowed to run about the laboratory one hour.

Second experiment on the same dog. This animal was again chloroformed, and one minute after the heart's action had ceased the needle was reintroduced through the fifth intercostal space. The heart responded to the puncture and was soon beating twice in a second. It continued to pulsate regularly two minutes, after which it became gradually weaker until it finally ceased. The right ventricle was punctured in both cases.

EXPERIMENT XV.—Mongrel, female, aged one year, weighed nine pounds. Dog narcotized with chloroform. The puncture was made two minutes after cessation of heart's action, and one minute and a half after respiration had stopped. The heart responded promptly to the irritation of the needle, and blood soon spurted from it with a *per saltum* motion. The chloroform had been removed as soon as the puncture was made, and the tongue was then drawn forward so as not to interfere with the entrance of air into the lungs. Artificial respiration was resorted to about one minute and a half after the puncture was made. The dog was promptly and fully resuscitated.

Second experiment on the same dog. Chloroform again administered while the needle remained in the heart. It was now plugged, and, consequently, there was no hemorrhage. The dog came rapidly under the influence of the drug; respiration soon ceased, but the heart's action continued seven minutes after the cessation of breathing. The second efforts at resuscitation began one minute after cessation of the heart's action. The dog was again resuscitated by the same measures which had already been successfully employed, and are fully described in the report of this case.

Third experiment on the same dog. In this experiment the same methods were employed in the administration of the chloroform and the after-treatment of the dog, except the omission of artificial respiration. The respiration quickly ceased after the administration of chloroform had commenced, but the heart's action continued some minutes. The quantity of blood lost during the first experiment was probably about two ounces. During the other experiments there was no flow through the needle. The needle had been allowed to remain continuously in the heart from the time it was first introduced until after the thorax was opened. It had penetrated the cavity of

the right ventricle and there were found within the pericardium a few drops of blood. The needle had remained in the heart more than an hour, and during a considerable portion of this time the dog had been struggling or otherwise disturbed by our efforts at artificial respiration.

Experiment XVI.—Mongrel, male, aged three years, weighed twenty-eight pounds. Dog narcotized with chloroform. The heart was punctured one and a quarter minutes after the cessation of its action, and half a minute after breathing had ceased. The heart responded promptly, and pulsated quite strongly. Artificial respiration was commenced one minute after the puncture was made, and continued five minutes. The needle was introduced into the fourth intercostal space, and punctured the septum between the right auricle and the ventricle of the same side. There was no escape of blood, and no unaided respiration. The heart's action ceased about three minutes after the puncture was made.

Experiment XVII.—Mongrel, female, aged six months, weighed thirteen pounds. Dog narcotized with chloroform. The puncture was made in the fifth intercostal space, one minute and twenty seconds after cessation of the heart's action, and half a minute after respirations ceased. The heart responded after the lapse of a few seconds, and continued to pulsate four minutes. The post-mortem showed that the needle had entered the right ventricle. No efforts were made for the resuscitation of the animal mentioned in this report.

Experiment XVIII.—Skye terrier, female, aged one year, weighed fifteen and a half pounds. Dog narcotized with chloroform. The puncture was made in the fifth intercostal space, one and a half minutes after the cessation of the heart's action, the needle penetrating the right ventricle about one inch from the apex. The heart responded after the lapse of a few seconds, pulsated feebly but regularly for half a minute, and then ceased.

Experiment XIX.—Mongrel, male, aged one year, weighed twenty-four pounds. Dog narcotized with chloroform. In this case there was much difficulty in determining the exact time when the heart's action ceased. It seemed to cease about three minutes before the cessation of respiration. The puncture was made one minute after the stoppage of breathing, and the heart responded fairly well. Blood

flowed through the needle. Artificial respiration was resorted to, and after having been continued two minutes, the dog was able to breathe without assistance. He continued to respire fairly well three-quarters of a minute, after which the breathing became shallow and feeble, and the animal quickly died. Artificial respiration was quickly resorted to, but without perceptible benefit. The needle had entered the right ventricle. The post-mortem examination of the brain revealed a marked congestion along the line of the superior longitudinal fissure, with some ecchymotic spots in the superficial brain-substance.

Experiment XX.—Mongrel, male, aged seven months, weighed six pounds. Dog narcotized with chloroform. The puncture was made one minute and fifteen seconds after cessation of the heart's action, and thirty-five seconds after the animal had ceased to breathe. The heart responded to the puncture fairly well, although it continued to pulsate only two minutes. This animal showed no other signs of life after the puncture was made. The needle was introduced through the fourth intercostal space, and penetrated the right ventricle, but did not reach its cavity.

Experiment XXI.—Mongrel, male, aged eighteen months, weighed fifteen pounds. Dog narcotized with chloroform. The heart was punctured about three-quarters of a minute after cessation of its action. The needle had remained in this organ about two minutes before there was observed the slightest resumption of the heart's action. Its movements were then very feeble, although comparatively regular. About this time the animal made a few gasping respirations, and soon after these efforts the heart was observed to be beating tumultuously, and death speedily followed. Artificial respiration was continued about four minutes. The post-mortem examination showed that the needle had penetrated the right ventricle, but had not entered its cavity.

Experiment XXII.—Mongrel, male, aged four years, weighed fifteen pounds. Dog narcotized with chloroform. The puncture was made one minute after cessation of cardiac action, and forty-five seconds after the breathing had ceased. The needle passed through the fifth intercostal space, and entered the cavity of the right ventricle. The responsive action of the heart was prompt and favorable, and there

was a free flow of blood through the needle. Artificial respiration was kept up for five minutes. The heart pulsated six minutes after it was punctured.

EXPERIMENT XXIII.—Mongrel, female, aged two years, weighed twenty and a half pounds. Dog narcotized with chloroform. The puncture was made three and a half minutes after cessation of the heart's action, and thirty seconds after the animal had ceased to breathe. The heart responded promptly to the needle, and continued to beat fully six minutes. Artificial respiration was employed immediately after the puncture was made, and two and a half minutes later this dog was breathing without assistance. He continued to breathe thus for two minutes, when it was deemed proper to resume artificial respiration, although we failed to resuscitate the animal.

There had been a slight flow of blood through the needle, which had remained in the heart during all these observations, and when the thorax was opened it was found to have penetrated the right ventricle near its auriculo-ventricular septum. The lungs were found to contain numerous hemorrhagic infarctions and showed marked indications of inflammation. The abdominal cavity contained about three ounces of coagulated blood, which had been evidently poured out from a ruptured bloodvessel four days previous to this examination. Further examination revealed several deep lacerations of the liver.

EXPERIMENT XXIV.—Mongrel, male, aged one year, weighed twenty-two pounds. Dog narcotized with chloroform. The puncture was made through the fifth intercostal space, and the needle entered the cavity of the right ventricle. The flow of blood through the needle amounted to about one ounce and a half. The needle was introduced into the heart about one minute and a half after cessation of its action and about one minute after the animal had stopped breathing. Artificial respiration was promptly resorted to and kept up for six minutes. The heart responded promptly to the entrance of the needle and continued to beat regularly about two minutes, when it ceased. The post-mortem examination revealed a moderate congestion of both kidneys, a small clot on the anterior portion of the medulla oblongata, and also congestion of the spinal cord in the lumbar region. The latter condition was associated with a separation of the last lumbar vertebra from the first sacral.

EXPERIMENT XXV.—Mongrel, female, aged five years, weighed twenty-one pounds. Dog narcotized with chloroform. The puncture was made through the fifth intercostal space, and the needle penetrated the cavity of the right ventricle one minute and a half after cessation of the heart's action, and one minute after the animal had stopped breathing. The blood flowed freely through the needle. The heart responded promptly to the irritation—pulsations were feeble and continued only two minutes and a half. Artificial respiration was resorted to promptly after the puncture was made, and continued five minutes.

EXPERIMENT XXVI.—Mongrel, male, aged four years, weighed sixteen and one-half pounds. Dog narcotized with chloroform. The puncture was made two minutes after cessation of the heart's action, and one minute after the animal had ceased to breathe. The right ventricle was punctured by the needle and about one-fourth of an ounce of blood had escaped when the instrument was withdrawn. The heart responded fairly well to the needle, and its pulsations continued two minutes and a half. Artificial respiration was commenced two minutes after the puncture was made, and continued four minutes. The post-mortem examination revealed the fact that the lungs were studded with hemorrhagic infarctions. Some of the infarctions were larger than a pea, while others were no larger than the head of a pin. Two lobes of the lungs were completely consolidated. There was also a slight laceration of the liver.

EXPERIMENT XXVII.—Mongrel, male, aged one year, weighed thirteen pounds. Dog narcotized with chloroform. The puncture was made through the fifth intercostal space, and penetrated the lower portion of the right ventricle one minute after cessation of the heart's action, and forty seconds after the animal had ceased to breathe.

The heart failed to respond for one minute, and then the needle was moved by my assistant, when the organ began to pulsate strongly, but its action gradually became more feeble, and finally ceased after the lapse of three minutes. Artificial respiration was not commenced until after the heart had resumed its action, but it was continued about four minutes.

EXPERIMENT XXVIII.—Mongrel, male, aged three years, weighed twenty-three pounds. Dog narcotized with chloroform. The heart was punctured one minute after cessation of both pulsation and res-

piration, these functions having ceased at the same time. The resumption of the heart's action was prompt but feeble, and continued only one minute. Artificial respiration was promptly employed, and continued a few minutes after death. It was found very difficult fully to narcotize this animal. It required more than three times the quantity of chloroform which we had been accustomed to use in similar cases. It likewise occupied us fully three times as long as the other cases. The needle entered the right ventricle near its base.

EXPERIMENT XXIX.—Mongrel, female, aged three years, weighed thirty-four pounds. Dog narcotized with chloroform. The puncture was made through the fifth intercostal space, and the needle entered the right ventricle midway between the base and apex one minute and a half after cessation of the heart's action, and one-half minute after respiration had ceased. The responsive action of the heart was prompt, and it continued to pulsate about four minutes, but feebly toward the end of that period. Artificial respiration was soon commenced and continued five minutes. The post-mortem examination revealed a large hemorrhagic infarction in the right lung, marked congestion of both kidneys, ecchymotic condition of both the psoas muscles and the surrounding tissues, and a complete separation of the last lumbar vertebra from the first sacral, with rupture of the ligaments.

EXPERIMENT XXX.—Mongrel, female, aged one year, weighed twenty pounds. Dog narcotized with chloroform. The heart was punctured through the fifth intercostal space and penetrated to the cavity of the right ventricle midway between the base and apex. The needle was introduced into the heart one minute and three-fourths after the cessation of its action, and one-half minute after the animal had ceased to breathe. The heart did not respond promptly, although there was a free flow of blood through the needle. The needle was freely moved, but without causing the heart to pulsate. Artificial respiration was commenced and the heart began to beat strongly at long intervals, one minute after it was penetrated. Artificial respiration was kept up during this period, and continued several minutes after cessation of the heart's action. The post-mortem examination revealed a hemorrhagic infarction of the middle lobe of the right lung, which was surrounded by an inflamed and solidified ring nearly an inch in width. There was also a marked congestion of the left kidney.

EXPERIMENT XXXI—Mongrel, male, aged five years, weighed thirty-two pounds. Dog narcotized with chloroform. The puncture was made through the fifth intercostal space, one and a half minutes after cessation of the heart's action, and half a minute after the animal had ceased to breathe. This puncture did not produce a responsive action in the heart, and the needle was partially withdrawn, since it was believed to have passed a little to the posterior of that organ, and was reintroduced, being now thrust backward and forward, and distinctly felt to enter the central organ of the circulation, but no pulsations followed. Artificial respiration was commenced about one minute after the heart was punctured, and it had been continued two minutes, when the animal suddenly gasped, and then made about six full inspirations. No pulsation of the heart occurred until after the animal made the first gasping inspiration, although three minutes had elapsed since the heart was punctured, but that organ now continued to pulsate feebly one minute. The final cessation of the heart's action was synchronous with the final stoppage of the breathing. The post-mortem examination revealed the fact that the final puncture had perforated the right ventricle midway between the base and apex, while in the first instance the needle had entered the upper portion of the inferior vena cava. The thoracic cavity contained about three ounces of blood which had escaped from the opening made by the first puncture. Both kidneys were markedly congested.

EXPERIMENT XXXII.—Mongrel, female, aged one year, weighed sixteen pounds. Dog narcotized with chloroform. The puncture was made through the fifth intercostal space, and the needle entered the right ventricle near its base, one minute after cessation of the hear's action, and about twelve seconds after the animal had ceased to breathe. The heart did not respond for one minute, but then began to pulsate feebly, and continued so to act for one minute, when it finally ceased. In the meanwhile the artificial respiration, which was commenced immediately after the puncture was made, had been steadily kept up, and was continued for five minutes. The post-mortem examination revealed several large hemorrhagic infarctions in the lungs, which had given rise to considerable inflammation and consolidation.

EXPERIMENT XXXIII.—Mongrel, male, aged two years, weighed twenty-four pounds. Dog narcotized with chloroform. The puncture was made through the fourth intercostal space, and the needle entered

the right auricle close to its auriculo-ventricular septum, one minute and fifteen seconds after cessation of the heart's action, and half a minute after the animal had ceased to breathe. The heart responded to the puncture, and pulsated strongly and regularly one minute, when the needle was withdrawn, and consequently we are unable to state accurately how long the heart's action continued. Artificial respiration had been promptly commenced, and was continued for five minutes. The post-mortem examination revealed hemorrhagic infarctions in the lungs, with marked inflammatory action; a partial separation between the last lumbar vertebra and the first sacral, with inflammatory changes in the lower portion of the spinal cord, and likewise about an ounce and a half of blood in the thoracic cavity, and about one-fourth of an ounce in the pericardial sac. This escape of blood had evidently been from the puncture in the auricle.

Experiment XXXIV.—Mongrel, male, aged five years, weighed twenty-five pounds. Dog narcotized with chloroform. The puncture was made one and a half minutes after cessation of the heart's action, and half a minute after the animal had ceased to breathe. The needle had entered the right ventricle near its base. The heart responded promptly, but the duration of its action was not recorded. Artificial respiration was promptly commenced, and continued four minutes. The post-mortem examination revealed nothing which is regarded as important in connection with this report.

Experiment XXXV.—Mongrel, male, aged one year, weighed fourteen pounds. Dog narcotized with chloroform. The puncture was made in the fifth intercostal space, and the needle entered the right ventricle one minute after cessation of the heart's action, and forty seconds after the animal ceased to breathe. The heart soon commenced to pulsate. Artificial respiration was immediately employed, and when it had been kept up one minute the dog was breathing without assistance. This favorable condition continued three minutes, when it was again found necessary to resort to artificial respiration, which was continued six minutes. The heart pulsated eight minutes. Post-mortem examination revealed a large hemorrhagic infarction in the right lung, an extensive laceration of the liver, and a considerable quantity of extravasated blood within the peritoneal cavity.

Experiment XXXVI.—Mongrel, female, aged two years, weighed nine pounds. Dog narcotized with chloroform. The puncture was

made one minute after cessation of the heart's action, and forty-five seconds after the animal ceased to breathe. The heart responded very feebly to the puncture, and continued to pulsate about two minutes. Artificial respiration was promptly resorted to, and when it had been kept up a little more than one minute the dog began to gasp, and continued to breathe without assistance three-quarters of a minute. The post-mortem examination showed that the needle had punctured the inferior vena cava. The thoracic cavity contained about three ounces of blood, which had just escaped from the wound made in the vein.

EXPERIMENT XXXVII.—Mongrel, male, aged two years, weighed eighteen pounds. Dog narcotized with chloroform. The puncture was made through the fifth intercostal space, and the needle entered the apex of the heart one minute after cessation of its action, and forty-five seconds after the animal had ceased to breathe. The heart responded promptly, pulsated regularly and strongly nearly six minutes, and only became feeble and irregular toward the end of this period. Artificial respiration was faithfully employed. The post-mortem examination revealed a partial separation of the last lumbar vertebra from the first sacral, which had resulted from a rupture of ligaments.

EXPERIMENT XXXVIII.—Mongrel, female, aged one year, weighed twenty-five pounds. Dog narcotized with chloroform. The puncture was made one minute and thirty-five seconds after cessation of the heart's action, and half a minute after the animal had ceased to breathe. The blood flowed freely through the needle, but the instrument remained entirely motionless. Artificial respiration was promptly employed, and the dog showed some signs of recovery when it had been continued a minute and a half; he then gasped a few times and died. The post-mortem examination revealed the fact that the needle had passed through the base of the right lung, entered the right auricular appendage, and passed through this into the auricular cavity.

EXPERIMENT XXXIX.—Terrier, female, aged one year, weighed eight pounds. Dog narcotized with chloroform. The puncture was made through the fifth intercostal space, and the needle entered the apex of the heart one minute after cessation of its action, and a half minute after the animal had ceased to breathe. The heart responded promptly, and continued to pulsate fairly well nearly three minutes. Artificial respiration was kept up about six minutes, but the

animal at one time during this period made a few gasping respirations. The post-mortem examination revealed small hemorrhagic infarctions in the left lung.

EXPERIMENT XL.—Mongrel, male, aged nine months, weighed twenty-one pounds. Dog narcotized with chloroform. The puncture was made one minute after cessation of the heart's action, and more than two minutes after the dog had ceased to breathe. The needle had been passed through the fifth intercostal space, and entered the right ventricle. The heart responded promptly—pulsations feeble and tardy—but it continued to act three minutes. Artificial respiration had been promptly employed, and was continued until after the death of the animal. Hemorrhagic infarctions were found in the lower lobe of the left lung, surrounded by inflammatory consolidation. There was, likewise, congestion of the meninges along the superior longitudinal sinus of the brain.

There have already been reported forty experiments on animals suffering from traumatic injuries, and we now append a report of twenty experiments on healthy, uninjured dogs.

EXPERIMENT XLI.—Black and tan, male, aged two years, weighed sixteen pounds. Dog narcotized with chloroform. The puncture was made two minutes after cessation of the heart's action, and one minute after the animal had ceased to breathe. The heart's pulsations promptly returned. Artificial respiration was immediately employed, and the animal was soon breathing without assistance. This favorable condition continued about two minutes, when the dog suddenly fell on his side, and respirations ceased. Efforts were again made for the resuscitation of this animal, but were unavailing. The post-mortem examination revealed the fact that the needle had entered the superior vena cava, in close proximity to the heart. There was a small quantity of blood found in the thoracic cavity, although none had escaped through the needle. It was thought that death, in this instance, was caused by an injury to the nerves, but the autopsy failed to demonstate it.

EXPERIMENT XLII.—Mongrel, female, aged one year, weighed ten pounds. Dog narcotized with chloroform. The puncture was made one minute after cessation of the heart's action, and one and a

half minutes after the animal had ceased to breathe. The heart responded promptly to the puncture, it pulsated strongly, and the animal was so far restored as to breathe without assistance. This favorable condition continued only three minutes, when the respirations suddenly ceased, and all further efforts for restoration were unavailing. The post-mortem examination showed that the auricle had been punctured, and that there had been some blood poured out into the pericardial sac—probably the quantity did not exceed five or six drops.

EXPERIMENT XLIII.—Mongrel, female, aged two years, weighed fourteen pounds. Dog narcotized with chloroform. The puncture was made one minute and thirty-seven seconds after cessation of the heart's action, and half a minute after the animal ceased to breathe. The heart responded satisfactorily, and the dog slowly recovered without assistance. It was intended when this puncture was made to enter the right ventricle instead of the right auricle, which had been made an objective point in the two preceding cases.

EXPERIMENT XLIV.—Esquimaux dog, female, aged two years, weighed sixteen pounds. Dog narcotized wtih chloroform. The puncture was made one minute after cessation of the heart's action, and a half minute after the animal had ceased to breathe. The heart responded promptly, and the dog commenced breathing within a few minutes without other assistance. The needle was withdrawn after the lapse of a few minutes, and, inasmuch as the animal had already, apparently, fully recovered, he was again narcotized with chloroform. The heart, in this instance, continued to pulsate three minutes after the animal had ceased to breathe. The second puncture was made one minute after cessation of the heart's action, and four minutes after cessation of respiration. The heart responded rather feebly to this puncture; its pulsations continued six minutes, but we failed to resuscitate the animal, although artificial respiration was thoroughly employed. The post-mortem examination showed that the right ventricle was penetrated in both instances.

EXPERIMENT XLV.—Mongrel, female, aged one year, weighed nine pounds. Dog narcotized with chloroform. The puncture was made fully three minutes after cessation of the heart's action, and one minute after the animal had ceased to breathe. There was observed during the administration of the chloroform, a marked spasm of the

diaphragm. The heart responded feebly, and continued to pulsate only one minute. Artificial respiration was employed, but without producing any marked beneficial results. The small aspirator needle was used in making the puncture. The post-mortem examination revealed the fact that the right ventricle had been penetrated.

Experiment XLVI.—Mongrel, female, aged one year, weighed eleven pounds. Dog narcotized with chloroform. The puncture was made one and a half minutes after cessation of the heart's action, and one minute and fifteen seconds after the animal ceased to breathe. The heart responded feebly, and continued to pulsate two minutes. Artificial respiration was unsuccessfully employed. The post-mortem examination showed that the right ventricle had been penetrated, and there were a few drops of blood found within the pericardial sac.

Experiment XLVII.—Terrier, male, aged two years, weighed thirteen pounds. Dog narcotized with chloroform. The puncture was made one minute after cessation of the heart's action, and half a minute after the animal had ceased to breathe. The heart responded promptly, and the dog began to respire without having received much assistance, at the end of two minutes. This animal fully recovered. The puncture was probably made in the right ventricle, since it was intended for this part of the organ.

Experiment XLVIII.—Mongrel, male, aged two years, weighed twenty five pounds. Dog narcotized with chloroform. The puncture was made one and a half minutes after cessation of the heart's action, and one minute after the animal had ceased to breathe. The needle was kept in place two minutes, and then withdrawn. There had been no escape of blood through it. Artificial respiration was commenced soon after the puncture was made, and was kept up fifteen minutes. The post-mortem examination showed that the needle had penetrated the right ventricle. There were found a few drops of blood within the pericardial sac.

Experiment XLIX.—Terrier, male, aged six months, weighed eight pounds. Dog narcotized with chloroform. The puncture was made one minute and fifteen seconds after cessation of the heart's action, and one minute after the animal had ceased to breathe. The heart responded soon, and continued to pulsate three minutes. Artificial

respiration was promptly commenced, and continued ten minutes. There had been in the meanwhile escape of a few drops of blood from the instrument. The post-mortem examination showed that the right ventricle had been penetrated, and a small quantity of blood was found in the pericardial sac.

EXPERIMENT L.—Terrier, aged three years, weighed sixteen pounds. Dog narcotized with chloroform. The puncture was made one minute after cessation of the heart's action, and a quarter of a minute after the animal had ceased to breathe. The heart did not respond promptly to the needle, but commenced to pulsate feebly after a few seconds. Artificial respiration had been continued three minutes, when the dog began to show signs of returning animation, and finally fully recovered after the lapse of twenty minutes. It is presumed that the needle entered the right ventricle, since this part had been made the objective point.

EXPERIMENT LI.—Mongrel, female, aged two years, weighed ten pounds. Dog narcotized with chloroform. The puncture was made two minutes after cessation of the heart's action, and one minute and forty-five seconds after the animal had ceased to breathe. The heart responded rather feebly, and continued to pulsate feebly when the needle was withdrawn. Artificial respiration had been commenced about one minute prior to the withdrawal of the needle, and blood had been flowing through it quite freely. There had certainly been lost, in this manner, at least half an ounce of blood. The animal so far recovered as to breathe about three minutes without assistance. Artificial respiration was continued several minutes after the unaided respiration had ceased. The post-mortem examination revealed the fact that the needle had penetrated the superior vena cava just above the auricle, which I had intended to puncture. Four or five ounces of blood were found within the thoracic cavity.

EXPERIMENT LII.—Mongrel, female, aged nine months, weighed nine pounds. Dog narcotized with chloroform. Puncture was made three and a half minutes after cessation of the heart's action, and half a minute after the animal had ceased to breathe. The heart did not respond promptly, but one minute after the needle was inserted it pulsated regularly, and with considerable force, which continued until the needle was withdrawn. One minute later fully half an ounce of

blood escaped through the needle. The post-mortem examination showed that the needle had penetrated the heart in the centre of the right ventricle. There was not a trace of blood within the pericardial sac.

Experiment LIII.—Mongrel, female, aged two years, weighed twenty-five pounds. Dog narcotized with chloroform. The puncture was made two minutes after cessation of the heart's action, and half a minute after the animal had ceased to breathe. The heart resumed its action half a minute after the puncture was made. Two minutes later the dog was breathing rapidly without assistance, and continued thus to breathe about three minutes, although during the last minute of the period the respiration became less frequent and more shallow. Artificial respiration, which had been commenced immediately after the puncture was made, was discontinued three minutes, while the dog was breathing unaided, but was recommenced when this assistance was again demanded, but failed to produce the desired results. The post-mortem examination showed that the needle had penetrated near the centre of the right ventricle. Three or four drops of blood were found within the pericardial sac.

Experiment LIV.—Mongrel, female, aged six months, weighed thirteen pounds. Dog narcotized with chloroform. The puncture was made one minute and forty-five seconds after cessation of the heart's action, and forty-five seconds after the dog ceased to breathe. The heart responded to the needle half a minute after it was punctured. Some blood had flowed through this instrument—probably less than a drachm—when it was withdrawn. Artificial respiration had been commenced, and two minutes later the dog was breathing without assistance. The respiration was, at first, very shallow, but gradually improved, and the dog fully recovered. The puncture was intended to be made in the right ventricle.

Experiment LV.—Mongrel, female, aged three years, weighed twenty-five pounds. Dog narcotized with chloroform. The puncture was made four minutes after cessation of the heart's action, and one minute after the animal had ceased to breathe. The needle entirely failed to indicate any action of the heart until after independent respiration had been established, and even then its movements were very slight and feeble, which was fully three minutes after

the puncture had been made. Artificial respiration had been promptly employed, and continued two minutes before the dog showed any indication of returning animation. One minute later the animal was breathing without assistance, and continued thus to inspire about five minutes, when artificial aid was again resumed and kept up for two minutes, after which he breathed, unaided, seven minutes, and soon after died. The post-mortem examination revealed the fact that the needle had passed through the pericardium and entered the inferior vena cava, followed by a hemorrhage which had greatly distended this sac, and probably caused the death of the animal.

EXPERIMENT LVI.—Mongrel, male, aged six months, weighed ten pounds. Dog narcotized with chloroform. The puncture was made two minutes after cessation of the heart's action, and one minute after the animal had ceased to breathe. The heart responded feebly to the needle a half minute after it was introduced. The needle was promptly withdrawn before any attempt at artificial respiration was made. Two minutes after the commencement of artificial respiration the dog was breathing feebly without assistance. This favorable condition of things continued only about one minute and a half, when artificial respiration was again employed, but without success. It had been intended to puncture the right auricle. The post-mortem examination revealed the fact that the superior vena cava had been punctured. The pericardial sac was filled with blood.

EXPERIMENT LVII.—Mongrel, male, aged four months, weighed thirteen pounds. Dog narcotized with chloroform. The puncture was made two minutes and a half after cessation of the heart's action, and one minute after the animal had ceased to breathe. The heart responded *very feebly* to the needle. Artificial respiration was promptly resorted to and kept up while the needle was allowed to remain *in situ* fully three minutes before the animal showed the slightest indication of returning animation. The movements of the needle had gradually increased in strength and regularity. The needle was withdrawn as soon as the dog began to breathe without assistance. The breathing was very shallow at first, but gradually improved until complete recovery took place. Probably about a drachm of blood flowed through the needle. It is believed that the right ventricle was punctured, since this was the objective point in the case.

EXPERIMENT LVIII.—Mongrel, female, aged four months, weighed eight pounds. The puncture was made four minutes after cessation of the heart's action, and one minute after the animal had ceased to breathe. The introduction of the needle was followed by no responsive action. Artificial respiration was promptly commenced, and it was observed that every time the chest was compressed blood flowed freely from the needle, and when the loss of blood had amounted to about one drachm it was withdrawn. The needle was withdrawn ten seconds after the puncture was made, and is the only case in which no response was elicited where the cavity of the heart had been punctured. Artificial respiration was continued ten minutes. The post-mortem examination revealed the fact that the right ventricle had been punctured near its base. Not a trace of blood was found within the pericardium.

EXPERIMENT LIX.—Mongrel, female, aged three years, weighed twenty-three pounds. Dog narcotized with chloroform. The puncture was made three minutes and a half after cessation of the heart's action, and one minute after the animal ceased to breathe. The responsive action of the heart was prompt, but very feeble. The flow of blood through the needle was so profuse that it was withdrawn after the lapse of ten seconds. Artificial respiration was promptly commenced, and continued four minutes, until the dog was observed to gasp, from which time he gradually improved until he had fully recovered. The right ventricle was probably entered, since it was made the objective point of puncture.

EXPERIMENT LX.—Skye-terrier, male, aged four years, weighed twelve pounds. Dog narcotized with chloroform. The puncture was made two minutes and a half after cessation of the heart's action, and one minute after the animal had ceased to breathe. The heart responded very feebly, and this response lasted only a few seconds. There was no flow of blood through the needle. Artificial respiration was promptly employed, and continued ten minutes. The post-mortem examination showed that the needle had entered the right auricle. The pericardial sac was distended with blood, which had evidently come from the interior of the auricle.

Having completed the report of sixty experiments made on dogs, forty of which were animals suffering from complicating traumatic injuries, while twenty were perfectly healthy and

entirely uninjured, we will briefly present some of the results, and our conclusions drawn from this experimental study, with such explanations as will aid the reader in more fully comprehending these reports. There will be found incorporated in my report of these experiments, the post-mortem description of the gross lesions, and in all cases where this has been omitted, it has been because the examinations were entirely negative.

In the post-mortem examinations of the forty cases where we had a right to expect traumatic complications, they have been observed and described in fourteen cases. In the other twenty-six cases these examinations did not reveal any gross lesions. Commercial chloroform was employed in all our experiments. In the first fifty cases, which have been reported in the order in which they were performed, the chloroform was administered rapidly, and, so far as possible, atmospheric air was excluded from the animals, while in the last ten, the chloroform was administered slowly, and contained a large percentage of air. It is, therefore, evident, that in the first fifty cases the chloroform narcosis was accompanied by a certain degree of asphyxia. In the first eight experiments no other efforts were employed for the resuscitation of the narcotized animals than the puncture; while in the ninth case artificial respiration was resorted to, and afterward used more or less in all the cases, but employed with special care in the last twenty, which were the uninjured animals.

The cessation of the heart's action and of respiration as the result of the chloroform narcosis, has been noted in forty-seven of these experiments. In forty-four cases the heart's action ceased before respiration, but in the fortieth experiment the heart continued to pulsate one minute after respiration had ceased, and in the forty-second experiment the heart pulsated thirty seconds after the animal had ceased to breathe; while in the thirty-eighth the action of the heart and respiration ceased at the same time.

In thirty-four experiments, where the chloroform was administered rapidly, and without permitting atmospheric air to mix with the vapor of the drug during the inhalation, the

average continuation of respiration after cessation of the heart's action was nearly forty-one seconds, while the maximum in this class stands at two minutes, and the minimum is five seconds. There were, in this same class of experiments, ten cases in which the narcotized animal continued to breathe one minute or longer after the action of the heart had ceased, and only five cases in which the respiration continued less than thirty seconds after the heart had ceased to act. The ten experiments in which the chloroform was administered cautiously, atmospheric air being freely mixed with the vapor of the drug during its inhalation, give us a widely different result. In these ten cases there was not a single instance in which cessation of the heart's action occurred before the animal ceased to breathe.

The extremes are recorded in the report of Experiments LV. and LI. In the former experiment the heart's action ceased eight minutes before the animal ceased to breathe, while in the latter case the animal breathed only forty-five seconds after the heart's action was arrested. The average duration of respiration after cessation of the heart's action in these ten cases was two minutes and twelve seconds. The punctures made in the sixty experiments were as follows: In the right ventricle, 38; left ventricle, 6; right auricle, 6; the superior vena cava, 3; inferior vena cava, 2; apex of the heart, 2; not stated, 1. The resuscitations which followed these punctures were as follows: right ventricle, 9; right auricle, 1. The first forty experiments gave us only four recoveries, while the last twenty yielded six. The question will naturally be asked, Why this disparity? It should be remembered, in this connection, that the dogs experimented on in the first series were suffering more or less from traumatism, and consequently possessed less recuperative power than the twenty animals used in the second series, which were perfectly healthy, and entirely uninjured. Furthermore, the first series of experiments was made especially for the purpose of determining the effects of cardiacentesis in cases of chloroform narcosis, while the second series was intended to demonstrate its efficiency when em-

ployed in the treatment of these cases in connection with artificial respiration. Consequently, there was no resort, in the first eight experiments of the first series, to artificial respiration, or any other means of resuscitating these animals, and it is likewise true that in making the other thirty-two experiments of this series, we were chiefly intent on observing merely the effect of the punctures, and consequently did not make any systematic effort at resuscitation.

The most important question which presents itself here for our consideration is, What are the effects of a puncture of the heart in cases of chloroform narcosis? Let us now carefully examine the record of these experiments and determine their bearing upon this query. We find that there were sixty cardiac punctures, and that the heart only failed to respond in Experiments XXXVIII. and LVIII. A reference to the report of these cases shows that in the former instance the puncture was made one minute and thirty-five seconds after cessation of the heart's action, and one minute after the animal had ceased to breathe, while the post-mortem examination revealed the fact that the needle had passed through the base of the right lung, entered the right auricular appendage, and passed through this into the auricular cavity. This needle had failed to indicate any responsive action merely because it was so firmly held by the tissues through which it passed as not to be swayed by the feeble pulsations of the heart. In the latter case our report shows that the puncture was made four minutes after cessation of heart action, and one minute after the animal had ceased to breathe. In this instance the needle was entirely free to move, and it is, therefore, evident that it entirely failed to excite any responsive action in the heart, probably because of the loss of its vital power. A further examination of these reports shows that the needle puncture, unaided by any other means, was sufficient to arouse the heart into action in twenty-two of these experiments, while the average time which elapsed between cessation of heart action and the introduction of the instrument was one minute and twenty seconds; the longest period being two minutes, and the

shortest, one. The cardiac action thus excited continued in two cases; the other functions were promptly reëstablished, and the animals fairly recovered.

The real point of interest now centres in this question—Can the heart which has ceased to pulsate be goaded into action by needle puncture? If it be admitted that in these twenty-two experiments the heart had absolutely ceased to perform its functions, but was aroused into action by the needle puncture, then the affirmative is proven. Should it, however, be charged that the experimenter has failed to demonstrate cessation of the heart's action prior to the introduction of the needle, then the value of these experiments would be seriously questioned. Consequently, we will introduce other evidence, in order that the value of these experiments may be made more apparent. It will not be denied that the swaying movements communicated to the needle by the pulsations of the heart, when it has been introduced into that organ, should be accepted as positive proof of its action. The needle in this position transmits every movement of the heart as accurately as it is done by the writing lever of the sphygmograph. Consequently the operator, who watches these movements, is enabled to comprehend the peculiarities of the same.

An examination of the reports of the experiments shows that in thirty-two cases the heart did not promptly respond to the introduction of the needle, but its action was delayed in some instances as long as three minutes, and in other cases only a few seconds.

The following extracts from the report of these experiments are here introduced for the purpose of illustrating the subject under consideration. The heart was punctured in Experiment XXI. about three-fourths of a minute after cessation of its action. The needle had remained in the organ two minutes before there was observed the slightest resumption of its action.

In Experiment LIV. the puncture was made one minute and forty-five seconds after cessation of the heart's action, and forty-five seconds after the animal had ceased to breathe. The heart responded to the needle half a minute after the puncture was

made. Artificial respiration was then commenced and two minutes later the dog was breathing without assistance. The respirations were, at first, very shallow, but gradually improved and the dog fully recovered.

The last report conclusively shows that there had been a cessation of the heart's action, and that its resumption occurred without the use of any other means than the introduction of the needle. Additional evidence of this character is found in abundance in the reports of these experiments, but it is not considered necessary to proceed any further in this direction.

Attention is now called to the fact that in nearly all our experiments with chloroform, we have observed that cessation of the heart's action commonly occurs prior to the stoppage of breathing; but when the needle has been previously introduced into this organ the order is reversed. In support of this, the reader's attention is now directed to the following extract from the report of the tenth experiment: "The chloroform was reapplied and respiration ceased after one minute, but the heart still continued to pulsate four minutes. . . . The needle had been allowed to remain in the heart during the whole period of our experimentation.

Having already supplied the essential facts found in the record of our experiments, bearing on cardiacentesis in chloroform narcosis, the question may now be properly asked, Should the puncture be carried into a cavity of the heart in order that blood may be abstracted? The physiological condition of the heart and lungs in chloroform narcosis is well understood by the medical profession. The heart is always found in diastole and the veins in the lungs greatly distended with blood. I have made nearly one hundred and sixty post-mortem examinations of dogs killed with chloroform, and have universally observed these conditions, except in those cases where there had been a very free escape of blood just prior to the death of the animal. It may, therefore, be rationally claimed that blood may be advantageously drawn from the right side of the heart in cases of chloroform narcosis. I am, likewise, fully assured that this procedure is not only theoretically correct, but also entirely prac-

tical and highly advantageous. Let me ask, what more rational treatment can be adopted in cases of chloroform narcosis than the puncture of the heart and the abstraction of blood. In those cases where there is already complete cessation of heart action and respiration, what are the indications for treatment? The urgent indications are to restore promptly these important suspended functions. It may, however, be urged against this operative procedure, that it is not entirely free from danger; but the same argument may be urged with equal force against many operations. Furthermore, the desperate condition of a patient suffering from chloroform narcosis may justify a resort to measures which otherwise should not be employed.

The only deaths observed during my experimentation, which may be fairly charged to the puncture, are those in which the vena cava was penetrated. In these cases, a profuse hemorrhage into the thoracic cavity unquestionably influenced the fatal termination. The punctures made into the auricle were, in some cases, followed by the flow of considerable blood into the pericardial sac, and are not entirely free from danger. The punctures made into the ventricles are not attended by any hemorrhage from the interior of the organ, but there are occasionally found a few drops of blood within the pericardial sac, which has been poured out from some wounded cardiac vein.

The experimental study of cardiacentesis in cases of chloroform narcosis has enabled me to reach the following conclusions:

Firstly. Puncture of the heart, especially the right ventricle, stimulates muscular contractions and may be advantageously employed in the treatment of this morbid condition.

Secondly. The best results are obtained when abstraction of blood from the cavity of the ventricle is combined with the stimulating effects produced by the entrance of the aspirator needle.

Thirdly. Puncture of the right ventricle is a safer and more efficient operative procedure than puncture of the right auricle.

DISCUSSION.

DR. N. P. DANDRIDGE, of Cincinnati.

I feel much embarrassed in offering any remarks upon this paper, which is based upon so many experiments. The conclusions have been carefully drawn. The interest of such experiments depends upon the practical deductions which can be drawn as to the application of the procedure to the human being. Here, I think, we should be exceedingly careful in applying the deductions from experiments to practical purposes. The conditions under which the experiments were performed, and the conditions under which accidents occur in the human being are so exceedingly different, that deductions from the one are to be very carefully applied to the other. In these experiments, the anæsthetic was pushed to a dangerous limit, and in many cases overwhelming doses were given at once. In all cases it was given until dangerous symptoms manifested themselves. The accidents which occur from chloroform happen very frequently, probably in the majority of cases where only a small quantity has been given, and very often soon after the administration has commenced, the accidents, probably, being due to a reflex action upon the inhibitory apparatus of the heart. In the experiments reported there seemed to be a want of explicitness in regard to the time after cessation of the heart's action, that it could be aroused by the punctures. In most cases the puncture was made within one minute, or a shorter time. In accidents with chloroform it is not uncommon to have recovery take place after apparent cessation of the heart's action for a long time. I think that the experiments would have been of more value if they had been directed to an elucidation of this question of the period during which the heart could be aroused to action—whether or not, at the end of five or ten minutes, cardiac puncture would have the effect of re-establishing the heart's action.

In the paper of Dr. Senn, on air embolism, a few years ago, he found that in animals where there was impending death from the injection of air into a vein, a certain number of these animals might be saved by direct aspiration of the right auricle, provided it was done rapidly, and provided that the quantity of air was not excessive. He found that three animals out of ten were relieved in this way. His

object was to relieve the distention of the auricle, and thus relieve the paralyzed condition of its walls. The object was not, as I understand it, to stimulate the heart by traumatism, but was actually to draw off sufficient of the contents of the heart to allow the auricle to contract. This seems to have been only in part the object of Dr. Watson, who, in the majority of cases, relied on the stimulating effect of the puncture of the heart muscles themselves.

In regard to the conclusion which he draws, as to the relative efficiency of the puncture of the right ventricle instead of the right auricle, I have nothing to say. I should presume, *a priori*, that it was easier to puncture the right auricle, and also safer.

This subject is to me of especial interest, as I have lost one case by chloroform, and one by ether. Any light upon this subject which will enable us to manage these cases more satisfactorily is very desirable. It seems to me that in the practical deductions to be made from these experiments, we should be exceedingly careful in applying them to man, particularly where it involves such a grave procedure as puncture of the heart. A large number of experiments would be necessary to test the value of this procedure as compared with artificial respiration, the use of nitrite of amyl, and particularly the subcutaneous injection of atropia. The latter can always be done readily and quickly, and its effect on the cardiac and respiratory centres is well established. The preliminary injection of atropia and morphia a short time before the use of the anæsthetic in a grave operation, particularly where the patient is suffering from shock, has a decided preventive influence against sudden heart failure.

Dr. John B. Roberts, of Philadelphhia.

The paper of Dr. Watson has been instructive on at least two points—one intentional, and the other, perhaps, unintentional, although none the less so on that account. He shows the comparative innocuousness of puncturing the heart with a small needle, particularly if some point like the ventricle is selected. He shows indirectly the great danger of giving chloroform as an anæsthetic in any case, possibly cases of parturition excepted. I doubt if he could have killed so many dogs with ether.

His experiments prove very positively that there is more danger in puncturing the auricle than in puncturing the ventricle. This would naturally be suggested by the fact that the ventricle has a much

thicker wall than the auricle. Where the needle is left in the heart the persistent motion of the organ will probably have a tendency to lacerate the thin wall of the auricle, which, moreover, would be less likely to prevent extravasation than would the thick wall of the ventricle.

The point raised by Dr. Dandridge, that in these experiments a great deal of chloroform was given, while in the human race only a small quantity is employed, does not seem to me to be against the operation, for if it does well where a large quantity of chloroform has been given, it should do better on a human subject where a small quantity has been given, provided that man and the dog are equally suited to the same operative procedure.

The paper of Dr. Senn, read a year or two ago, is *apropos* as enforcing the lesson that puncture of the heart done by a proper method is not a serious operation. The use of narcotics and atropia in ether and chloroform narcosis is valuable, but atropia is rather slow in its action on the heart, if it is a heart tonic, although probably not so slow as digitalis.

In my paper[1] referred to by Dr. Watson, I speak of the experiments of Dr. Westbrook, who punctured the heart for other conditions than chloroform narcosis, his idea being that by drawing blood from the right side, he might relieve the distended heart. I have, apparently, saved life by phlebotomy in cases of great engorgement of the lungs in acute pneumonia; and have seen relief follow in cases of damaged heart, from the same procedure. Dr. Westbrook, of New York, and Dr. Leuf, formerly of Brooklyn, but now of Philadelphia, have reported cases in which heart puncture was performed on the human subject.

I was gratified to hear Dr. Watson say that puncture of the right ventricle was safer than puncture of the right auricle. Dr. Westbrook believes that the proper place to perform the operation is in the third interspace close to the right edge of the sternum, which enables him to tap the auricle. I suggested that it would be better to perforate the ventricle of the right heart by introducing the needle through the fourth interspaces, about one and a half or two inches to the left of the median line of the sternum.

Another point suggested by the paper is with reference to the possibility of other operations on the heart. Dr. Block claims that he

[1] Transactions of the College of Physicians of Philadelphia, Jan. 3, 1883.

has been able to suture the hearts of rabbits, and that it is a simple operation, requiring but three or four minutes. He finds that opening of the right and left ventricle and entire compression of the heart for the application of sutures can be supported by rabbits for several minutes. Even if cardiac pulsation and respiration stop during this mechanical interference with the heart's movement, death, he asserts, does not necessarily ensue. I do not know Dr. Block, and believe that we should be careful in accepting such statements, though such operations do not seem impossible. In my paper above referred to I have given the references to his published account.

Dr. L. McLane Tiffany, of Baltimore.

There are two points in which I think that the experiments are open to marked criticism. The first is, that it is well known that under chloroform the dog behaves in a peculiar manner, so that for experimental dog work, chloroform is useless. The dog is very apt to die suddenly. Chloroform is banished from laboratories where dogs are required. It is, therefore, not proper to make any deduction from the dog to the human subject, the dog being under the influence of chloroform.

The other point is in regard to the conclusions which were adduced by experiment, that it was advantageous to puncture the heart in chloroform narcosis. If this is to be applied to man, I think that it merits criticism. To do an experiment in the laboratory, and advise others to do it in hospital and private practice, is not right. Experimental work in the laboratory is good, but it must be supplemented by practical human experience on the part of the experimenter before it is to be recommended for use to others.

Dr. R. A. Kinloch, of Charleston, S. C.

About two months ago, I had a case of chloroform narcosis in which heart puncture was tried. While I have been accustomed to use the A.-C.-E. mixture, my assistant prefers chloroform. While I was preparing for the operation my assistant put the patient under the influence of chloroform. After a time, we both noticed something wrong with the patient, and I was convinced that he was about to die. I resorted to the usual measures without avail. Dr. Edwards suggested heart puncture, and I told him he was at liberty to try it. He endeavored to puncture the right ventricle, without effect. I then took the needle

and introduced it myself. No effect was observed. There was no movement and no flow of blood from the needle, which was that of a hypodermic syringe.

DR. T. J. DUNOTT, of Harrisburg, Pa.

I should like to relate the history of a case in which the heart was twice punctured with an aspirator trocar without immediately fatal results. The patient resided in Williamsport, and the history was given to me by Dr. Thomas Helsby, who was present at the post-mortem examination, in 1877. The patient, from early life, had suffered from mitral insufficiency, and when operated on had a greatly dilated heart, and was suffering from orthopnœa, great pulmonary congestion, and general anasarca. She was at the time under the care of two homœopathic physicians. They regarded the case as one of pericarditis, with effusion, and attempted to aspirate the pericardium with the result of penetrating the ventricle and removing with the aspirator ten to fifteen ounces of blood, which rapidly coagulated. They did not recognize at the time that they had penetrated the heart. The urgent symptoms were relieved temporarily, and, in consequence, they made a second attempt after some days' interval, but the patient died in a short time. At the post-mortem the marks of the punctures were distinctly perceptible.

DR. WATSON. Dr. Dandridge has objected to the fact that I did not specifically call attention to the period of time which might elapse after the heart had ceased to act, when it was possible to arouse it into action by puncture. A careful reading of the paper will show that I succeeded a number of times in exciting the heart's action even three minutes after it had ceased. In one instance I introduced the needle four minutes after the cessation of the pulsation, but failed to get any response. It would, of course, be impossible to elicit a response even from puncture after the lapse of a certain time. It is quite certain that there is a slight irritability which remains a certain period after the cessation of both the heart's action and respiration. To determine this period exactly would probably require innumerable experiments.

In regard to puncture of the right ventricle instead of the right auricle, I would state that there are two reasons for this recommendation. In the first place, the wall of the right auricle is much thinner, and contains less muscular tissue than the wall of the right ventricle.

The auricle is, in every respect, a sort of reservoir for the blood. The propelling power, to a great extent, belongs to the strong muscular walls of the ventricle. There is another reason why we should not puncture the right auricle, for, as the wall of the auricle is thin, there is more danger of blood escaping. The needle left in the wall of the ventricle has not produced laceration, neither does it produce laceration when left in the thin wall of the auricle. I think that when the auricle is punctured there will always be a certain amount of leakage. In no case of puncture of the right ventricle was there any leakage from the interior of the cavity. There is, however, risk of puncture of the cardiac veins, with the occurrence of hemorrhage, which is comparatively trifling.

In regard to the difference of action of chloroform upon man, and upon the dog, I may state that I am familiar with all that Dr. Tiffany has said. The difference is, however, in favor of the man and not in favor of the dog. Chloroform cannot be continued safely with the dog for any length of time. In some experiments reported to this Association some years ago, I showed that when I attempted to continue the anæsthetic action of chloroform on dogs for two hours I lost half of the animals. The same physiological conditions pertain to the dog as to man, when you use chloroform, and the same pathological conditions are found in the dog as when it is given to man. When an animal is destroyed with chloroform it is found that the heart is in diastole, and that the veins of the lungs are engorged. This is the universal result, unless profuse hemorrhage has taken place. The first object is to irritate the heart and cause contraction. I think if the paper is read, it will be found that puncture does irritate the heart, and cause contraction. Muscular contraction may take place, but if the heart is still distended with blood, and if the heart does not contract sufficiently to force out this column of blood, what is the result? Therefore, I believe that, in addition to puncture, we should enter the cavity of the ventricle and draw off some blood. My experiments show conclusively the advantage of this. The cases in which I succeeded in drawing off blood did better than those in which no blood was drawn.

Atropia may be good, but I may say that, as a heart elevator, I should rather have a needle in the heart, and I should have more confidence in this than in the administration of atropia. In none of my experiments did I puncture within a period less than one minute, and, in some instances, three minutes elapsed. The rapid administration of

chloroform does not produce the best condition for the resuscitation of the animal. One man in this country believes that it should be forced on the patient, and he always administers it in that way. My experiments show that when I gave it rapidly the heart's action continued a little longer than the respiration in two instances, but when I gave it cautiously, which I did in the last ten experiments, I found that in every instance its action was much more uniform, and that it did not kill the animal so unexpectedly. When chloroform had been given cautiously, I found that it was possible to resuscitate the animal after a longer period. The heart ceased to beat, but the animal continued to breathe. In one instance the animal breathed for eight minutes after cessation of the heart's action. I could arouse the animal two or three minutes after the heart had ceased to beat when the agent had been given cautiously, but in those cases in which it had been forced, it was with great difficulty that the heart's action was aroused. I would argue, therefore, that it was better to give it cautiously, and with an abundance of atmospheric air.

In the first forty cases, my object was to kill the animal, so as to make a post-mortem, and determine the lesions present. In the last twenty healthy animals, I resuscitated six, and when they recovered from the puncture they continued to live, and are still living.

SOME REMARKS ON HYPERTROPHY OF THE TONGUE, OTHERWISE KNOWN AS LINGUA VITULI, LINGUA PROPENDULÆ, AND MACROGLOSSIA.

BY T. J. DUNOTT, M.D.,
OF HARRISBURG.

THIS affection of the tongue, although rare, is mentioned by nearly all surgeons of large experience. I have had but one case, the history of which I am about to record. The annals of surgery, however, show that although the disease be infrequent, it has occupied the attention of surgeons, and has been known and described for centuries, even by Celsus.

Zacchias relates that he saw at Rome, in 1628, a male infant whose tongue protruded some distance beyond the lips, the child being otherwise in good health. It lived to the age of fourteen months, and died without obvious cause. Bertholin and Sauvages also speak of enlargement of the tongue in newborn infants. Peary and Laurent speak of cases in which enlargement dated from the birth of the patient. In the case cited by Mirault, the patient, aged thirty-four years, had suffered from infancy. So likewise in nearly all reported histories of this deformity, the beginning of the growth was in early life.

Bertholin refers to a case related by his pupil Bagdun, where the child was born with the tongue protruding, and as the infant grew the organ increased to the size of a calf's heart.

In a case related by Dr. Humphrey in the *Med.-Chir. Trans.*, vol. xxxvi. page 104, the measurement of the organ was great, and ordinarily it was contained in a bag which was supported on

the head. The dimensions are not given. Mr. Syme also mentioned a case of protruding tongue in a girl aged fourteen years, in whom the member protruded several inches. The tongue was removed, but the patient died a few days after, from inflammation and swelling of the remnant and parts of the larynx.

Hypertrophy of the tongue, according to Dr. S. D. Gross, may be limited to its muscular substance, to its papillæ, or to its mucous investments, or there may be a simultaneous affection of all its structures, constituting general hypertrophy of the organ.

Hypertrophy must not be confounded with tumors, which consist of nævi or simple warts, or of polypi, and fatty, fibrous, and fibro-cellular growths; nor with cysts, which are met with in the substance of the tongue. This type of hypertrophy, referred to by Dr. Gross, is nothing but an over-development of normal tissue, which is necessarily associated with prolapse, when it is in any degree considerable, and, therefore, for it the name of "propendula linguæ" is not inappropriate.

Most authors who have met with it consider it congenital, but I am disposed to believe that, except where it is associated with other congenital imperfections, especially with idiocy, it is rather the result of inflammatory conditions affecting the various tissues of the organ.

The case I refer to was that of a girl, aged twelve years, who was admitted to the surgical ward of the Harrisburg Hospital, on January 6, 1886, with an enormously enlarged tongue. When she presented herself for treatment, the organ protruded between the lips for several (3⅝) inches, and was enclosed in a muslin bag. Its surface was covered with patches of exfoliating mucous membrane, from underneath which there constantly dribbled a sero-purulent discharge. The thickness of the exfoliating mucosa was considerable; it was cracked and fissured, the sero-purulent fluid exuding between the cracks. The greatest circumference of the tongue was nine and three-quarters inches, and its greatest width was four and three-quarters inches.

The lips were greatly distended, and the angles of the mouth were not far removed from the external opening of the auditory canal. By a great effort a small space, a quarter of an inch, could be exposed

between the lower and the upper incisors, which were displaced, and almost horizontal in direction. The tongue itself was firm to the touch, of almost cartilaginous feel. Its mucous membrane was nearly an eighth of an inch in thickness, splitting off in flakes, and dark in color, except near to the lips, where it was bright red, with swollen papillæ. Its odor was extremely fetid. The patient could only partake of liquids, and she swallowed with difficulty. She was emaciated, and in great distress. Her pulse was feeble, her countenance pale, and altogether she was in a most pitiable and precarious condition.

On inquiry, I learned that the prolapse of the tongue was only of two months' duration, that it began without apparent cause, there never having been previously noticed any enlargement of the member. On January 15th the measurement demonstrated very considerable increase in size, its length being four inches beyond the lip to the tip; the width between the commissure, five inches. She was nourished to a great degree by rectal injections, for the pressure of the growing mass upon the teeth and gums induced such a degree of pain whenever an attempt was made to feed her *per orem*, that only small quantities of liquid food could be swallowed. The rectal injections were kept up until the 19th, when it was evident that the patient would perish unless relieved by ablation of the growing mass.

She was, therefore, at 2.45 P.M., placed under the influence of an anæsthetic (chloroform), to which she responded readily. A perineal needle was passed under the ranine artery on each side, about one and a half inches behind the lip; the thread was withdrawn and tied in a loop, which was permitted to hang out of the angle of the mouth—the intention being to command the arteries and stump remaining by traction after the section. The vessels were very large, and pulsated violently, their increased size being plainly noticeable to the finger when it was introduced for the purpose of establishing their location. The next procedure was to pass vertically two sharply curved accupressure needles on each side of the frænum, and about an inch from the lips, and behind these one was passed horizontally. The tongue was then seized with volsellum forceps, drawn forcibly forward, and a piece of rubber cord an eighth of an inch in diameter wrapped tightly behind them until a very considerable wall was formed, thereby blocking up the buccal opening, so that in case of severe bleeding the patient would be protected from choking by the entrance of blood into the trachea. The tumor was removed with scalpel and scissors,

the knife being so directed as to secure a conical stump. During the section it creaked under the knife, and there was scarcely any bleeding at this stage of the operation. When the mass was removed, the opening of the mouth through which it protruded presented a great cavity, the dimensions of which can be approximately estimated from the measurements which have been previously cited. The lower jaw was partially dislocated, and the upper and lower incisors and cuspid teeth, which in both maxillæ presented horizontally, were removed before the section. They were all loose in their sockets, and were readily removed by the fingers without the aid of instruments. The stump of the tongue remaining was removed with scissors, dissecting under the enveloping muscles and mucous membrane until all of the dense, fibrous mass was taken away. The rubber cord was then untied, and the springing vessels seized with compressing forceps and ligated, the loops of thread controlling the stump so readily that it was easy to seize them. At first the bleeding was copious, but it was so readily controlled that in no way was it a source of great anxiety. The tumor removed weighed over ten ounces. After cleansing the mouth with a permanganate solution, the remaining portions of the stump were brought together with carbolized silk ligatures. Very little of the tongue was left; in fact, nothing but the mucous membrane and some of the muscular structure. There was no after-bleeding of any severity. During the operation the condition of the patient was precarious, and I feared she would die before its completion. The pulse fluctuated, and at times it was imperceptible, but under artificial respiration and hypodermic injections of brandy and ether it increased in volume, and finally all necessary steps were completed at 6 P.M. The patient soon became conscious, partook of nourishment *per orem*, and expressed a feeling of great relief. She was given an enema of the yolks of eggs and brandy, which was repeated frequently during the day and night. She retained it, and on the morning following the operation was in good condition, and expressed herself as being so much improved as to cherish expectations of complete recovery. The measurement of the removed portion in greatest circumference was ten and a quarter inches; length of prolapse, five and three-quarters inches; upper surface width, five and three-quarters inches; under surface width, four and three eighths inches. The stump lay about two inches back of the alveolar margin. The mouth was open, and the lower jaw, from long pressure, was stiff and subdislocated, and could not be closed; it also protruded beyond the alveolar line of the upper jaw.

I have omitted to state that the first steps of the operation as described were preceded by section of the muscles and mucous membrane covering the floor of the buccal cavity. The genio hyoglossi and investing membrane were severed at the symphysis; this was done with curved scissors, because of the extreme difficulty of reaching the parts with a scalpel. The mass beyond the lips gave a good purchase, and all of the pharyngeal and contiguous structures were so readily pulled forward that the entire mass was easily included in the Esmarch tube. This device facilitated the remaining operative procedures to such a degree that the operation, which is ordinarily difficult, became very easy of performance. Its bloodless history made it still more so. I beg leave to say, in this connection, so far as the method is concerned, that while other surgeons may have practised it, I am not aware of their having done so, and possibly may be entitled to whatever credit is contained in it, if in the future it serves those who may choose to apply it as well as it did me on this occasion.

The further progress of the case was all that could be desired. On January 31st the stump was entirely healed, the tip reaching nearly as far forward as the frænum; articulation was tolerably distinct; she had no difficulty in keeping the lips closed, and the mouth had a normal appearance, except that the lower jaw still protruded. She was then discharged from the hospital. On March 23, 1887, her brother stated that the patient could eat and drink without difficulty, had no soreness about the tongue, and was gaining flesh rapidly.

In the transactions of the *American Surgical Association*, vol. iii., is a paper written by Dr. B. Norris, in which he presents a tabular statement of recorded cases of tongue extirpation for cancerous growths, numbering 126. He remarks that it is only within thirty years that authors have ceased to regard the operation as impracticable and cruel, and in reference to cancer of the organ, states that it is fitting to applaud the surgeon who affords his patient a renewed hope of relief from a most pitiable condition. He also quotes Mr. Heath as saying that he has been thanked more than once by dying patients for giving them a few days' relief from suffering, while they survived. This, it must be remembered, is a record of the relief afforded in cases of a cancerous nature, where all hopes of a permanent cure has been abandoned. Dr. Norris, while admitting that

the tabulated statement is too limited to permit any useful deduction as to the fatality following the different methods of removal, draws attention to the fact that when the knife was used, 43.7 per cent. of the cases were fatal; when the scissors were employed in the ablation, 23 per cent., and with the écraseur, only 16.7 per cent. succumbed. He also states that Annandale was of the opinion that the knife was a factor in producing an unhealthy state of the wound. In cases of great hypertrophy of the tongue, it would be difficult to operate, for the removal of the whole, or a portion of the member except through the mouth, unless the base be attacked by splitting the symphysis, or by the operation of Nunnelly, where the chain of the écraseur is carried between the base of the jaw, and the hyoid bone in the median line into the mouth, through an opening previously made, the chain being prevented from slipping forward, when thus introduced, by the introduction of pins vertically, and also, in a horizontal position. Paget's method includes a section of the genio-hyoglossi muscles from their attachment to the symphysis, and the mucous membrane covering the floor of the mouth, thus enabling the operator to draw the tongue well forward, so that the loop of the wire écraseur can be readily passed far back, and tightened, so as to sever the organ close to its connection with the larynx. Page and Langenbeck's method, by the thermo-cautery, and that of Collis and Gamgee, by incisions into the cheek and along the base of the jaw for the employment of the écraseur chain, are methods which are apparently dictated by the fear of bleeding. On the other hand, Whitehead dismisses this apprehension; when operating, he uses a gag and cuts the muscles with scissors. The vessels are tied or twisted after division, and he states that the hemorrhage is easily stopped by a sponge held in the grasp of forceps, until the bleeding point is secured by a ligature. The remaining tissues connected with the tongue are then transfixed by a needle conveying a loop of silk, in order to draw forward the floor of the mouth to guard against secondary hemorrhage, it being recommended to remove the ligature on the second day after the operation. Dr. Shrady's method of

tying the linguals before attempting partial or complete extirpation, in the paper of Dr. Norris, is reported as being the means of securing an almost bloodless operation.

It seems that to every operator the question of hemorrhage as a source of danger, has presented itself, and a vast amount of ingenuity has been expended in devising methods for operation in which this danger may be reduced to the minimum, and the liability of suffocation from the entrance of blood into the trachea at any stage of the operation be avoided. The prone position of the patient, and the use of a coil of rubber tubing as previously suggested, seem to me to be admirably adapted to secure this most desirable result. In the prone position, with the head of the patient properly supported, it is impossible for the blood to invade the trachea—but with the use of the rubber coil the operation is absolutely bloodless, and the vessels are easily secured when the tension of the rubber is released; the position of the patient can be arranged to suit the convenience of the operator. Nearly all of the operations which have been devised for the total ablation of the tongue, have been accomplished by one of four methods: 1st, the oral or Paget's; 2d, the symphyseal, or the method of Syme and of Sédillot; 3d, the submental, introduced by Regnoli in 1838, and its subsequent modification by Nunnely, of Leeds, in 1861, by whom it was very much simplified. Paget's preference in the ablation seems to have been for the écraseur; the steps of his operative procedure, and that of Nunnely I have previously referred to. The second method, that of Syme and of Sédillot, involves the section of the lower lip, the symphysis, and the submental integument, thus enabling the operator, by separating the lower maxilla, to pull the tongue well forward so as expose the lingual arteries, and tie them, completing the ablation either with the knife or the chain of the écraseur. The operation is finished by wiring the two sides of the jaw, and closing the wound in the neck and lip with suture. Regnoli opens the floor of the mouth by making a crescentic incision parallel with the base of the jaw, avoiding the facial arteries, and from its centre a second cut is made downward to the hyoid bone, the

two flaps are then dissected from the jaw, and the tongue pulled downward upon the neck through the external wound. The tongue is then separated from its extrinsic muscles, the vessels ligated, the excision made with the knife or écraseur, and the external wound closed with interrupted suture.

Nunnely modifies this operation by dissecting between the genio-hyoglossi (after making a small incision in the skin) below the symphysis, until the mucous membrane of the buccal floor is reached at the frænum lingua; this is punctured, and the tongue severed either by the chain of the écraseur, or the galvano-cautery loop. Jordan carries a straight incision through the cheek from the upper lip above the commissure, to the anterior border of the masseter muscle, thus exposing the entire tongue. The vessels are then tied, and the tongue drawn forward—pins are used to transfix behind the circumvallate papillæ, they being thrust through in a vertical direction; the wire loop is passed over the pins, the tongue is removed, and the operation completed by closing the wound in the cheek. The operations which I have described above are mostly intended for the removal of malignant growths, in which, to a greater or less extent, the circumjacent parts are involved; but in cases of simple hypertrophy, when the growth is very large, the buccal cavity entirely filled, and a corresponding degree of vascularity is present, and the tongue necessarily protruded, by the stretching of the lips and the protrusion forward of the lower maxilla, the operation through the mouth is easier of performance, because of these conditions.

The angles of the mouth are, under such conditions, widely separated, and they can be drawn still further apart, so as to aid the easy introduction of needles transversely through the base of the organ. There is more difficulty in introducing vertically the pins on each side of the frænum, but even this was readily accomplished after severing the attachment of the genio-hyoglossi muscles. The pins used were sharply curved, and were introduced from below upward, until their points protruded behind the circumvallate papillæ. The great mass protruding beyond the lips gave firm purchase to the volsellum

forceps, and the larynx was readily lifted forward and upward, far beyond its natural position, the rubber band was then applied so as almost entirely to close the opening into the pharynx, thus doing away with any risk of entrance of blood into the trachea. The vessels were large in my case, and spurted vigorously, but were readily seized by hæmostatic forceps and tied.

Hypertrophy of the tongue has been described by many writers, from a very early date in the annals of surgery, but I have not been able to find any records which analyze or classify the cases in which amputation has been performed, with the exception of 42 cases by Clarke, and referred to by Dr. Agnew, in his work on surgery. Of this number, 21 were females, 17 were males, and in 4 the sex is not given. The causes which give rise to it are said to be ptyalism, and attacks of fever, epilepsy, etc., but usually it is congenital There is no certain known treatment of any avail, except excision or complete amputation, although Clarke states that 9 out of the 42 cases were cured by compression, aided in some cases by lotions; 18 were cured by amputation; 7 by ligature; and 5 by excision of a portion of the mass. Of the 3 fatal cases, 1 died from pyæmia, 1 from laryngitis, and 1 from pneumonia. The pyæmia case was treated by ligature of the lingual arteries. Of the other fatal cases, one by excision and compression, and the other by ablation with écraseur. The tongue when removed in the case I have reported, was stripped of its mucosa, which was much thickened. It was as readily peeled off as the skin of an orange, and points of suppuration underlied its entire surface. The mass of the tongue consisted of a dense whitish growth, which creaked when incisions were made into its substance. It was somewhat moist on sections of its tissue, and homogeneous in appearance, without any apparent concentric arrangement of filaments. The muscular tissue forming the outer layer was much thinned, and changed in color to a very pale red, and was therefore degenerate. Sections of the tumor, after being hardened in chromic acid, and stained with carmine or hæmatoxylin, demonstrated that the bulk of the enlargement was

made up of a network of delicate lymph vessels, and very much enlarged lymph spaces, with increase of connective tissue, and, apparently, of regenerate bundles of striated muscular fibres. Plate 2102, on page 621, third volume of Agnew's *Surgery*, fairly represents the appearance of a section with a power of 300, with this exception, that the lymph spaces are not so large in my specimen, and that lymphoid cells in great numbers are surrounded by connective tissue walls, and take the place of the blood corpuscles depicted in the plates. I refer to the apparent regeneration of muscular tissue, which, if true, would show a combination in this case of muscular elements with varicose capillary lymphatics. A tumor of this kind is however, denied as a pathological fact. Still, I am inclined to think that in the preparation there is a much larger amount of striated muscular fibre in the central portions of the growth than there could be, except under the supposition of muscular regeneration. The diameter of the fibres in the specimen, I think, is much less than normal fibre. Ernst. Wagner says:

"That transversely striated muscular fibres are found after degenerative losses of muscular substance, where the primitive bundles degenerate and are destroyed, and in injuries where the muscular stroma, fibres, nerves, and bloodvessels are destroyed in consequence of laceration or of suppuration. Regeneration proceeding from the perimysium, from the sarcolemma, especially from the muscular corpuscles, perhaps also from the nuclei of the capillaries, in a manner similar in all probability to the physiological formation of muscle."

The tumor removed was, therefore, a lymph angioma to which, possibly, may be added the affix myomatous.

I have learned recently that the patient operated on is in good health, and that her articulation, which is defective from the loss of the front teeth, is as good as it is with others who have met with a similar deprivation.

DISCUSSION.

Dr. L. McLane Tiffany, of Baltimore, Md.

I will show the photographs of a case which has already been reported. The history which has been given by the reader of the paper would do very well for the case under consideration. The patient was a negro child, aged five years, and the hypertrophy, so-called, dated from birth. Deformity of the lower jaw existed, which is usually the case. The incisor teeth projected directly forward and the alveolar process also. Ever since the first few months of life the child had been unable to cover the tongue with the lips. The operation was done by putting the child to sleep, pulling the tongue forward and cutting it off with the Paquelin cautery. The incision was made about vertical with the long diameter of the tongue. There was no attempt to make flaps, although I had at first intended to do so. The tongue was cut across just in front of the circumvallate papillæ. There was no hemorrhage whatever until I came to the ranine arteries. One of these after one spurt did not bleed, the other bled for some time and I applied a ligature. This was the only ligature. There was no trouble after the operation, and in a week the patient was eating potatoes and meat, and at the end of ten days left hospital. At this time the jaws were beginning to assume their normal position. The after-treatment consisted in the use of warm water rendered pleasant to the taste by the addition of a little sugar and tincture of myrrh. When the patient left the hospital there was a healthy granulating sore which was contracting.

VAGINAL HYSTERECTOMY.

BY J. FORD THOMPSON, M.D.,
OF WASHINGTON, D. C.

THE subject of hysterectomy, I believe, has not been brought before this Association, and as it seems to me to be one of the most interesting and important surgical questions of the day—as the disease for which it is principally employed has always been—I have determined to report briefly two cases, recently operated upon, that the subject may be discussed from a strictly surgical standpoint, with the hope of settling the vexed question whether it is an operation to be encouraged or condemned.

My experience with it extends only to these two cases; the first, nearly two years ago, ending in death; and the second, only two months since, ending in recovery.

The fatal case I shall relate in a few words, as a minute report is not essential to the object I have in view.

CASE I.—Mrs. A. E., white, aged forty-five, had been married seven years. She had given birth to one child three years ago, the labor being very difficult. She was under the care of Dr. Walsh, of Washington, who diagnosed malignant disease of the cervix. In April, 1885, he asked me to see her with him, as he thought it a proper case for an operation. Upon examination I found great destruction of the cervix, the ulceration extending above the internal os. She had been losing a great deal of blood at each menstrual period, which was prolonged but not attended with much pain. She had the usual anæmic appearance of women suffering from this disease accompanied by great loss of blood, although her general condition was not particularly bad. The uterus was quite movable and there did not appear to be either infiltration of neighboring tissues or glandular enlargements. I recom-

mended an operation, and she was admitted to the Garfield Hospital, April 20, 1885.

She was given the usual preparatory treatment; baths, vaginal douches, and proper regulation of the diet and the bowels.

April 23. Consultation. It was decided to avoid hysterectomy, if possible, and to limit the operation to high amputation of the cervix, with the use of the sharp spoon and cautery, as the condition might require.

24th, 4 P. M. The patient, having been prepared in the morning, was etherized and placed in the lithotomy position. The cervix was seized with two Museaux forceps and brought as near the vulva as practicable but not as low as I desired, because the forceps easily tore loose. The spoon was used to scrape away the softened tissues, and then the scissors to free the vaginal attachments. After cutting away the remainder of the cervix with the scissors, I again attempted to use the spoon, but found that the peritoneal cavity had been opened through Douglas's cul-de-sac. There had been considerable hemorrhage, and as it appeared that this operation would be incomplete and unsatisfactory, I decided, after a moment's consultation, to extirpate the organ. I freed the uterus anteriorly from the bladder without much difficulty. Then I passed a strong temporary silk ligature around each broad ligament and tied them tightly, and split the body of the uterus into two nearly equal parts with scissors. Difficulty was experienced in applying the temporary ligatures because I had no special instruments; but I finally succeeded with my fingers and forceps. Each half of the uterus was then brought down; the ligaments transfixed, tightly tied beyond the temporary ligatures, and the stump cut away. There was no loss of blood from the ligaments, but constant oozing from the parts severed in the first part of the operation. Warm water was used and the bleeding points secured as far as possible, but the oozing continued to some extent. A knuckle of intestine protruded through the wound and was replaced. After cleansing thoroughly with carbolized water, the vagina was loosely packed with iodoform gauze, and a compress to the vulva was held in place by a T-bandage. *Sutures were not used.*

The patient was very weak, so several hypodermic injections of whiskey were given. She rallied, and was soon able to take stimulants by the mouth. During the night she complained of pain in the pelvic region, and vomited several times. Injections of morphia were given to relieve pain, and champagne to stimulate and to allay vomiting.

25th. 11 A. M. Pulse 148, resp. 25, temp. 103.2°. Extremely weak; abdomen tender and tympanitic. The tampon was removed and the vagina irrigated. Notwithstanding the efforts made to save her, she died at 3.30 P.M., twenty-four hours after the operation.

Drs. Ralph Walsh, G. W. Johnston, and Cutts, and the house staff assisted in the operation.

CASE II.—Mrs. M. H., white, aged fifty-five, was admitted to the Garfield Hospital on February 26, 1887. She was married at nineteen; had had eight children and three miscarriages; and the menopause was passed at fifty-one. In May, 1886, she noticed a yellowish discharge from the vagina, which became bloody in a few weeks. The loss of blood gradually increased and the intervals became shorter. She consulted a physician, but did not improve under his treatment; in fact, she grew worse from loss of blood, although she did not suffer from pain. She came under the care of Dr. Mauss, of Washington, who requested me to see her with him in January, 1887. Dr. Mauss had diagnosed carcinomatous disease of the cervix, and had called me with a view of having me perform some radical operation, for which the patient, her friends, and he were anxious.

I found her general condition fairly good, although she stated that she was greatly reduced in flesh; she presented a decidedly cachectic appearance, which might have been merely from the loss of blood. Vaginal examination showed advanced ulceration of the cervix, especially the posterior lip, which was almost entirely destroyed. The disease had extended backward, encroaching upon the posterior cul-de-sac. I drew the uterus down with a hook so as to examine it more closely, to determine the extent of the disease and the condition of the neighboring parts. The disease extended along the cervical canal, certainly to the internal os, and probably beyond, but I could not discover any evidence of its having spread beyond the uterine walls. The uterus was freely movable, and there was no enlargement of the glands. The bleeding during the examination was quite free, but the patient did not complain of pain. I expressed the opinion that this was a case for supravaginal amputation or hysterectomy; and that a choice of the operations would be made at a subsequent examination.

A month later, not having heard anything of the patient in the meantime, I was asked by Dr. Mauss to see her again with Dr. J. Taber Johnson and himself. She was subjected to about the same examination as at first, but I did not discover any change, either

locally or generally, in her condition, although she thought it worse. We all decided that this was a proper case for vaginal hysterectomy, and she was advised to go to the Garfield Hospital, where she was admitted February 25, 1887.

The preparatory treatment consisted of vaginal douches of warm carbolized water, hot-water baths, vaseline, and warm blankets.

Feb. 27. An alcohol bath, a cathartic at night and an enema in the morning were given; the bowels were freely opened.

28th. 11 A.M. With the assistance of Drs. G. W. Johnson and Cutts, and the house staff, the patient being etherized, I began to operate. With two Museaux's forceps, the uterus was brought to the vulva and the canal and cervix thoroughly irrigated with mercuric chloride solution, 1 to 3000, which was almost continuously used during the operation. The patient was in the lithotomy position, and the speculum was not used.

I began by freeing the neck posteriorly, as it was important to get well beyond the disease, which had extended in this direction. The dissection was then continued entirely around the cervix with the scissors. I then separated the bladder from the cervix. Before completing the anterior dissection, I passed a strong silk ligature with a long curved needle through the lateral vaginal vault of either side, and tied them tightly; and then I cut the included portion from the uterus. These ligatures presumably enclosed the uterine arteries and the lower part of the broad ligaments. After their section the uterus was depressed with much greater ease. The separation was then renewed in front, and the peritoneum opened, to which was attached a loop of silk. The posterior cul-de-sac was treated in a similar manner. I easily tilted the uterus through the anterior wound by pressure with the fingers passed through the posterior opening. The remainder of the right broad ligament was then transfixed, tied in two portions, and cut as near as possible to the uterus. The organ was then brought down and the left broad ligament similarly treated. There was no loss of blood. After cleansing, and examining closely for hemorrhage, I brought the peritoneal flaps downward by the ligatures, and fastened them together by two catgut sutures. A small rubber drainage-tube was placed in each end of the wound, beyond the peritoneal sutures, fastened below, and cut short, so as to lie well up in the vagina. The vagina was loosely packed with iodoform gauze; a compress was placed at the vulva; and a T-bandage was applied.

There was no shock. The catheter was used every four or five hours.

Lime water and milk, in small quantities, and whiskey, when necessary, were ordered.

March 1. Patient slept quite well and had very little pain.

2d. 4 A.M. Pulse 140 and weak; ammonium carbonate and digitalis were given by the house physician.

9 A.M. Pulse 140, temp. 99.6°. When I saw her at 11 A.M., there was some tenderness over the lower part of the abdomen, so I removed the dressings. There had been a slight discharge of bloody serum, but there was no fetor, and her general condition was considered favorable. I removed the drainage tubes and irrigated the vagina with the bichloride solution, 1 to 5000. This was to be used twice daily.

3d. Vomited several times during the night. Digitalis and ammonium carbonate were stopped.

At 9 A.M. Pulse 108, temp. 99.2°.

4th. Bowels moved by enema. Nourishment increased.

5th. Frequent desire to urinate.

6th. Slight tenderness over the bladder. Vaginal discharge purulent and somewhat offensive. Stopped use of the catheter.

7th and *8th.* Improving, but still has an irritable bladder.

9th. Appetite good and liquid food increased.

10th. Solid food given. General condition good, except the cystitis, for which I ordered potass. bicarb., and the injection of a weak solution of potass. acetat. into the bladder twice a day.

17th. Temperature normal; general condition good; but still some irritation of urinary bladder. The discharge from the vagina leucorrhœal. Dressed with iodoform gauze.

26th. Removed ligatures. A small granulating surface about the size of a ten-cent piece at the upper part of the vagina, which otherwise appeared perfectly normal.

28th. Discharge has ceased.

On the third day her temperature was 100.4°, and on the sixth 100.2°. Only once did it reach 101°, which was on the eleventh day, and was evidently caused by the cystitis.

It is scarcely worth the time for me to go deeply into the history of this exceedingly interesting operation; nor is it important more than to refer to laparo-hysterectomy, since its mortality has been shown to be so great—seventy-five per cent.—that it has been abandoned by all recent operators. As compared with vaginal extirpation, its dangers are so excessive,

that only insurmountable obstacles to the latter method could justify its performance.

It seems singular that years ago this operation should have been performed successfully by several operators with most satisfactory results, and that it then should have been followed by so many fatal cases that it was entirely abandoned, and almost forgotten for forty years.

Probably the first authentic case of vaginal extirpation was performed by K. M. Langenbeck, in 1813, and the patient lived thirty years after the operation. Sauter, in 1822, successfully extirpated the uterus by the same method, but the patient survived only a few months. And in 1830, Blundel, Recamier, and Delpech had successful cases; after which, owing to its many failures, it fell into disuse.

Freund revived interest in the operation in 1878, by a successful case of laparo-hysterectomy; and in the following year Czerny substituted vaginal extirpation, which was soon adopted by others.

The operation is, unquestionably, a formidable one, and has been considered very difficult and dangerous; but its technique has gradually improved until now we may feel assured that the difficulties and dangers are not in themselves sufficient to deter surgeons from undertaking it in properly selected cases.

There are various methods followed in its performance, and of course the one should be selected which lessens the duration and best avoids those accidents which are so liable to occur, without exercising the greatest care. But, unfortunately, there is no unanimity of opinion as to the method which most surely secures this immunity. These accidents are injury to the bladder, rectum, ureters, and, above all, hemorrhage. It would appear that any of the methods proposed would meet these indications, if done with sufficient care; but as some are easier than others, thus shortening the operation and lessening the liability to shock, it is important to select the method which appears to present advantages in these respects. We may enumerate at least six methods that are used at the present time.

1. Tilting the uterus backward and bringing it through the posterior vaginal vault.

2. The Müller, which consists in longitudinal divisions of the uterus.

3. Olshausen's, of drawing down and extirpatng the organ without turning.

4. Fritsch's, of beginning laterally at the broad ligaments.

5. Winckel's, by spiral incisions.

6. Richelot's, by clamp forceps.

My first case was a modified Müller operation, and was adopted at the moment as being, probably, the safest under the circumstances. It was not a fair test of hysterectomy, nor of Müller's method. The second was performed essentially after Fritsch, the only difference being that I first opened the posterior cul-de-sac for the reason already given, instead of leaving it until the last, as practised by him.

The use of the two deep lateral ligatures, including the lateral vaginal vault, part of the broad ligament, and the uterine artery, greatly facilitates the operative procedure, as the uterus is more easily drawn down, hemorrhage is lessened, and the tilting of the organ into the vagina accomplished without difficulty. As I have said, there was practically no loss of blood, and the operation was completed without any embarrassment.

In cases in which there is considerable enlargement of the body of the uterus, it might be better to follow the method of Czerny or Olshausen; but their methods are more tedious and necessitate the employment of more ligatures, which, I think, is objectionable.

Of late the method of Richelot has excited considerable interest, especially in France, and I have no doubt that it will be tried extensively, as it seems to simplify the operation and to avoid some of its difficulties, but, although I was familiar with its technique at my second operation, I had no desire to adopt it, because I had serious doubts about its possessing any superiority, except that of shortening the time of the operation. In his first case, he had hemorrhage, which was difficult to control, on account of tearing of the ligaments, which required the

application of several forceps, which were left in the vagina. Its superiority must be established beyond peradventure before it will meet with general approval by practical surgeons. To my mind it seems anything but surgical to crowd the woman's vagina with forceps, thus keeping the parts more or less open, and making antiseptic dressing almost impossible. It is true that they are left in *situ* only twenty-four or forty-eight hours, but this is a very important period in the after-treatment of the case. Nor can I see that the forceps are more certain to control hemorrhage than well-applied ligatures.

There is some difference of opinion as to the use of peritoneal sutures for closing the wound, and also of drainage, both of which were used in my case, but whether advantageously or not, it is difficult to say. Of course, where the sutures are dispensed with, there can be no necessity of drainage tubes; but on general principles I am in favor of suturing; and there is certainly no reasonable objection advanced against their use; and, as there was a profuse bloody serum discharged for several days, it would seem that at least in this case they served a good purpose; although, as only two sutures were used, the escape of this fluid might have been sufficiently free without them. I should certainly favor, at least partially, closing the vaginal vault by bringing the peritoneal surfaces together, although I am in doubt about the use of the tubes.

As to the dangers of the operation: Are they so great as to make us reject it altogether as many contend, or even hesitate to perform it in carcinomatous disease? It is practised for other conditions, displacements, irremediable by other means. But I desire to confine my inquiries to cases of undoubted cancerous disease. If it is an operation worthy of recognition, we should, as surgeons, give it our encouragement and support; if not, then we should condemn it. Although its history dates far back, it is a modern operation, so much so, indeed, that it is thought by many too early to express a decided opinion on its merits or demerits, from a therapeutical point of view; and, unfortunately, it seems at present unjustifiable to express a decided opinion upon this vexed question.

The statistics of immediate results are becoming more and more favorable, and I believe that in the hands of skilful operators it will soon lose its terrors, and be considered, in properly selected cases, as of rather easy execution. We need examine only the latest statistics to appreciate the great improvement, for until recently the mortality has been about 30 per cent., but now we find that several operators have reduced it much lower—in fact, to a point where it is very little, if any, higher than that of ovariotomy. Fritsch reports sixty cases with a mortality of 10 per cent.; Leopold has published twenty-six operations with but two deaths, and Klotz seventeen cases without a failure. Richelot reports thirty cases after his method, ten of them by himself, with a loss of three, which brings his mortality up to 30 per cent., which is the percentage I have given for all published cases. But should a mortality of 30 per cent., which I am sure will be more favorable in the future, deter us if we can prolong life or mitigate the sufferings of the remainder? Surgeons are constantly performing operations attended with greater danger to life and with as little, or less, hope of permanen timprovement without hesitation, and I am convinced that they will continue to do so in that large class of cases which are inevitably doomed to an early death, accompanied by the most excruciating suffering. I do not mean to imply that we should continue to perform or recommend this or any other operation if it should be proved that we are only abridging life and adding to its sufferings, as held by some, notably by Dr. J. Reeves Jackson, of Chicago, who published a paper on this subject not long since. I refer to his paper particularly, because it embraces all that can be said against radical interference in cancer of the uterus. If all he says concerning it be true, it certainly should be abandoned as a thoroughly unjustifiable procedure, but we know that his views are not entertained by the majority of men whose lives are devoted to this special field of labor, and who speak from vast personal experince and observation. Admitting that the immediate mortality is not so great as to cause its abandonment, I think it would be very difficult to convince a practical surgeon that the extirpation of a part of a dis-

eased organ is a more scientific procedure, or is followed by better ultimate results than its total removal. Nor is it by any means proved that the physical condition of the woman is worse after this operation than when left alone, or after some of the tentative; but, on the contrary, so far as I have been able to judge from a study of the reported cases and from surgical observations in general, the reverse is much nearer the truth. There is no doubt that there is a disease of the cervix, variously called cancroid, papilloma, or cauliflower excrescence, which is frequently curable by simple amputation of the neck, or by the sharp spoon or cautery, and I have seen the like; but I have never seen the case of a carcinomatous ulceration of the cervix or body cured by these measures, although I have performed them quite thoroughly. In such cases the only choice appears to be between total extirpation and supravaginal amputation, with the preference, at least theoretically, for the former.

I am not an enthusiast for this, or for any other operation for carcinoma, but in this, as in all other operations, I would follow that practice which is the outcome of the best clinical observation. There is at present no sufficient reason for excepting the uterus from the radical operation where we are insisting upon it in all other cases where it is practicable. It is too early to give any reliable statistics as to the question of recurrence, but as far as I am able to judge from what has been published, they are, unfortunately, as in carcinoma generally, far from being as satisfactory as I would like to report. It is possible that in this respect also, there will be a noticeable improvement in the future, as cases will be selected with more care, and the operation will not be performed as a *dernier ressort.*

DISCUSSION.

DR. T. R. VARRICK, of Jersey City, N. J.

A short time ago I received from our honorable secretary a programme of the proceedings of this meeting, and from it I learned that I had been appointed to discuss the paper just read.

Although in the course of a long professional career, having observed many cases of cancer uteri, I have had no experience in the operation under discussion. Such being the case, I am free to say that I have nothing new to offer, and I should deem it an insult to this honorable body to occupy valuable time in a reiteration of facts already known, which have been abundantly discussed, and which would serve as "venerable chestnuts" for the intellectual repast of the gentlemen present.

Not being able from personal experience to contribute aught to the "common stock of knowledge and understanding," so far as vaginal hysterectomy is concerned, what I may have to offer, will be simply in the vein of criticism as to the past.

All new departures, or revival of old methods, whether in medicine or surgery, should be received with caution, and thoroughly proven by the crucial test of clinical observation before receiving the sanction of surgeons as justifiable procedures.

Whether such procedures are likely to mitigate suffering, or prolong life beyond the average duration of the disease, if left to take its course without interference, is a question yet to be determined.

It seems to me that any operation or method of treatment, whose record does not show a prolongation of life beyond the utmost limit of duration of disease, if left to itself, is useless and should be avoided.

At this point let us consider how far vaginal hysterectomy meets the requirements mentioned above. The duration of cancer uteri is, according to Thomas, from three months to seven years.

According to Arnot, the average duration of all kinds of cancer, deduced from a record of fifty-seven cases, is 77.1 weeks, for true cancer 53.8 weeks, for epithelioma 82.7 weeks. According to C. C. Lee, one to three years. Of eight cases of which I have the record, occurring in my personal experience, the shortest period was two years, and the longest four years.

It is always difficult, and in some instances impossible, to indicate the period of commencement, partly on account of the repugnance of some to divulge their symptoms, and partly owing to the fact that their existing ailments are attributed to disease elsewhere.

A case illustrating the latter condition came under my notice a few years since. Mrs. A., aged thirty-eight years, the mother of three children, consulted me for, as she supposed, an affection of the bladder, characterized by strangury in an aggravated form. She denied having any vaginal discharge whatever; menstruation normal, as to quantity and time, and painless. I prescribed the usual remedies for her supposed difficulties with no benefit.

Although at the first consultation I suggested a possibility of her troubles being dependent on uterine disease, she refused to submit to a vaginal examination. After four months of ineffectual treatment she reluctantly consented to a physical exploration of the parts, with the following result: The cervix uteri was nearly destroyed by ulceration, the remaining portion hard and nodulated. The vaginal walls indurated, and the uterus firmly fixed and immovable. There also existed an offensive sanguinolent discharge, which gradually increased with the ravages of the disease, up to the time of her death, which occurred two years after the first vaginal examination. She admitted to me that the bladder trouble had existed three months before seeking advice.

It will thus be perceived that there is undoubted evidence that she suffered from the disease two years and seven months.

Similar cases might be cited, did time and space permit; but this one is sufficient to illustrate the difficulties attending an early diagnosis.

Having thus rapidly considered the probable duration of the disease, let us see how far vaginal hysterectomy has influenced the arrest or progress of the disease.

In this connection I am reminded of a frequent expression of my great preceptor in surgery, Valentine Mott, viz., "You hear of successful cases, but dead men tell no tales."

In statistical tables by Sara E. Post, published in the *American Journal of the Medical Sciences* for January, 1886, embracing reports of three hundred and fourteen cases of kolpohysterectomy for cancer, we find there died ninety-three, survived two hundred and forty-eight. Survived what? Disease returned, twenty-three; reported well, twenty-seven.

Of the twenty-three cases reported, in which the disease returned,

we find the longest period between the operation and recurrence to be one and one-half years.

In another column we find the number reported well, as above stated, to be twenty-seven; the longest period intervening to be two years. This period is too short to enable us to predict with certainty the non-recurrence of the disease.

That the published statistics of recovery should be received with caution is well illustrated by the report of two cases to the Obstetrical Society, of London, December 5, 1884, by Dr. W. A. Duncan. One was admitted to the Royal Hospital for Women and Children, December 11, 1883. On January 22, 1884, extirpation was performed, according to Schröder's method. "The patient made an uninterrupted recovery, and was discharged cured, on the twenty-ninth day, with an arched cicatrix in the vagina, but no induration whatever. She was readmitted on June 14th." On the 28th an indurated mass was felt on vaginal examination above its roof; pelvic glands enlarged. She died November 1st, following. Case two: patient admitted February 4, 1884; disease had existed eight months before admission. Extirpation was done February 26th, and death followed in twelve hours.

Of the rose-colored reports of operations, in which the mortality is reduced to twenty-four per cent., how many of the seventy-six per cent. of cures are of the kind reported above?

On this account many of the statistical tables lose a great portion of their value in not stating the length of time intervening between the operation and rendition of the report.

It will be seen that in no single case is there a record of continued freedom from disease, between the time of extirpation and the reported result, equal to the maximum duration of the disease assigned by the authors previously quoted. In view of the uncertainty which veils the question as to the inception of lymphatic involvement, a question which is by all known methods of diagnosis impossible to determine, should one be so fortunate as to see the case in its earlier stages, is a circumstance which should weigh heavily in deciding as to the justifiability of operative procedure.

Mobility of the uterus and absence of induration of the vaginal walls, are not evidence that lymphatic contamination has not already commenced.

Even the involvement of a single gland nestling deeply in the pel-

vis, shielded from recognition by integument, adipose tissue, muscle, fascia, and connective tissue, may prove a morsel of leaven, which by a process of proliferation, by stealthy steps, from gland to gland, infects the entire mass of pelvic, and in some instances also the inguinal glands, and as each becomes involved, it in its turn, proves a nucleus, furnishing material for increasing development, until the unfortunate patient succumbs to its ravages.

The scope of the operation is limited to the removal of the uterus, as, owing to anatomical reasons, the removal of diseased pelvic glands is impossible.

The operation of necessity is in many instances incomplete, and, therefore, useless.

In other words, it subjects the patient to danger of immediate death, as against a bare possibility of permanent recovery.

Dr. T. F. Prewitt, of St. Louis.

Dr. Thompson has covered the ground very thoroughly, and I believe that in the main his conclusions are perfectly correct. I thoroughly agree with him that extirpation is the better operation, and I do not know that I am prepared to go further, and say that on the earliest appearance of epithelioma of the cervix there should be extirpation of the whole organ. I believe that this would be the safer safer course, and I believe that ultimately this will be the course adopted. We all know how prone these carcinomatous growths are to return, how rapidly the tissues about the cervix become infiltrated, and how difficult it is so to conduct an operation as to remove all of this infiltration. We know the efforts that have been made to arrest the progress of the disease by the supravaginal operation, by the curette, the cautery, etc., and we know how frequently these operations fail. It is claimed that in some cases operated on in this way, there has been no return after fifteen years. I have suspected that these were not really cases of epithelioma, but such cases as Dr. Thompson has referred to, as papilloma, etc. We know the great encouragement that is derived from the thorough removal of epithelioma. Epithelioma of the lip, if removed early and thoroughly, frequently shows no disposition to return. If, however, it is allowed to go on for years, there comes a time when there will be infiltration beyond the seat of disease, and no cutting that we may do will check the growth, and the patient falls a victim either to his own disinclination to have anything done, or to the tardiness of the practitioner in advising early removal.

In the early part of the fall of last year, I had a case which is a good illustration of the advantages of the operation. The patient, fifty years of age, had for months had an offensive discharge tinged with blood, she had become emaciated, and her health was impaired. On making an examination, I found an epitheliomatous growth, which had extended in the direction of the right broad ligament, and had not involved the tissue to any extent. I was certain that the disease extended beyond the internal os. It seemed to me that the only course that offered any chance of prolonging life was hysterectomy. I told her that there was an operation which was less dangerous, but far less radical. I explained what might be hoped for in each case, and left her to decide. She was more than anxious for the hysterectomy. If she could not get rid of the disease, she wanted to die.

In that case I operated very much as Dr. Thompson did in his last case. I first made a circular incision around the neck, pushed up the mucous membrane and placed a ligature on both sides, so as to include the uterine arteries. I tied these and freed the organ higher up. The broad ligaments were then enclosed with ligatures in such a way that there could be no bleeding. The right ovary was brought into view during the operation and could have been removed, if desired. After I had removed the womb and cleaned out everything, there was a disposition for a knuckle of intestine to protrude. This was replaced and the ligatures attached to the broad ligaments brought down. The peritoneal surfaces came into contact, and the roof of the vagina was so completely closed that I thought it unnecessary to introduce sutures. I felt satisfied that the ligatures would serve as ample means for drainage. I dipped a piece of absorbent cotton into a solution of bichloride of mercury (1:1000), squeezed out the excess of fluid, dusted it with iodoform and applied it against the surface. This stuck to the parts so tightly that it was several days before I could get it away. The vagina was cautiously washed out every day, after the third, and suppositories of iodoform were gently inserted. The patient did very well. For several days there was slight delirium at night, but there never was high fever. Some were disposed to attribute the delirium to the iodoform, but it continued after the iodoform was stopped. She recovered. The infiltration had gone beyond the cervix, and had extended into the right broad ligament, and I made it a point to cut as far laterally as possible on that side. She has grown to be a stout, strong woman, and is in better health than for years, and I am certain that her life has been prolonged. I am satisfied that if any temporary operation had

been done, it would have placed her in better condition for only two or three months, when the trouble would have returned. If she now dies from cancer, it will probably be an internal form of the disease, and she will have an easier death than if the disease were vaginal. I believe that the operation is entirely justifiable and safe, if done early.

I should perhaps mention one of my failures. I was called to Illinois to see a case in which the physician was anxious to have the uterus removed. While I thought that the trouble extended pretty high, the uterus appeared to be movable, and I thought that it could be removed. I did not, however, appreciate the extent to which the disease had spread. I detached the mucous membrane and pushed it up. I then attempted to detach the bladder, but I found that every attempt to bring the uterus down simply tore loose the tissues. In attempting with a blunt pair of scissors, used as a dissector, to detach the bladder from the uterus, I broke through the uterine wall. In trying to avoid this, I made an opening into the bladder. It was impossible to avoid this. I then abandoned the operation. I expected the patient to die, but she got over the operation, and the last time I heard from her, two or three months after, she was still living. The wound in the bladder closed and there was no fistula.

Again, I would say, that I believe that it is better in all cases (I think that there is scarcely an exception), at the earliest moment that we are satisfied there is epithelioma of the cervix, to remove the entire organ. Of course, no one questions the advisability of removing the entire organ where there is sarcoma about the fundus, but I am now speaking about growths of the cervix itself. The operation should be done before fixation occurs. Fixation of the uterus is, I think, a contraindication to the operation.

Dr. E. H. Gregory, of St. Louis.

I do not know whether or not it is incumbent on me to say a word for old surgery. I was taught that the grandeur of surgery was to save every part possible. I should no more think of removing the entire uterus for epithelioma involving its neck, than I should think of removing the entire lip for a limited epithelioma of that part. We know that it is the least malignant of cancers. Who would think of removing the entire upper jaw for malignant disease, involving one-half of the jaw? The surgery of the lips and the surgery of the jaws seems applicable to the uterus. I am not disposed to sit here and have the

old ideas of surgery assailed without some evidence of resistance. The old surgical rule tells us to save all that is possible, and if a part of an organ is diseased, we are not warranted in extirpating the entire organ.

I could relate a number of cases where I have limited the operation to the cervix when my judgment told me that the disease was correspondingly limited, and my patients were living months and years after the operation. I can relate quite as many successes after this operation as can be related after the operation of extirpation of the entire organ. I can see no reason for a man entering the abdominal cavity, when it is possible to remove what seems to be diseased by limiting the operation external to that cavity. Again, we know that the disease is quite as likely to advance in the vagina as in the uterus. When it advances to the body of the uterus, it is apt to extend to the tubes and broad ligaments, but yet the uterus may not be fixed.

DR. R. A. KINLOCH, of Charleston, S. C.

I have a great respect for the old masters and for old surgery. I would ask my venerable friend if it is not a rule of old surgery as well as of modern surgery, to cut far and wide in all malignant diseases? Whether the old surgeon as well as the modern, did not recognize the fact that malignant disease spreads almost too rapidly for us? That it did not infiltrate tissues in all directions, that it did not spread by the lymphatics, veins, and tissues of the part? Did not the question come up with the old surgeon whether it was worth while to operate at all unless he could cut far and wide of the disease? I agree with my friend that many of the operations of modern surgery are performed more for displaying the skill of the operator than for the good of the patient, and I would agree in condemning these. I see reports of operations in neighboring large cities performed by brilliant men, in which cancerous disease of the pharynx or of the larynx is removed, and so many vessels were tied, and so many nerves cut. I would condemn such cases, but when we come to the case in point, where we have an organ suspended in the pelvis by ligaments easily divided, isolated to a certain extent from contiguous parts, and where, according to the great and grand doctrines of old surgery, we have a chance to cut far and wide of the disease, and if it can be proven by statistics that by cutting far and wide we do not jeopardize life too much, I ask, Is it not well to apply this good old rule? This must be determined by statistics. There is no other rule. On the one side there is the question of saving

or prolonging human life; on the other side, a useless operation. If it can be proven that in cancerous disease of the cervix the scissors or knife can be applied far and wide so as to prolong or save human life, I am in favor of that operation. If he cannot deny the statistics that operations on epithelioma and other cancerous diseases of the cervix do not go to save or prolong human life, because we cannot cut far and wide, then he must not attempt to stop the progress of surgery by saying that we must not cut as far as is necessary to save human life.

Dr. Charles B. Nancrede, of Philadelphia.

It is hardly fair to say that in carcinoma of the breast, it is necessary to remove all the structures of the chest. I would dispute the statement that failure invariably results. The questions relating to the anatomy of the uterus, its lymphatics and those of the vagina, and the route by which epithelioma propagates itself, cannot now be entered into, but these have an important bearing on the operation. In carcinoma of the breast we operate early, we examine the axilla for evidence of infiltration, and, unless we find it, we do not touch the part. In Philadelphia we can show a number of living cases, in which the primary and secondary growths in the lymphatics have been demonstrated beyond question to have been malignant, and yet the patients are living from four to ten or more years after the operation. I think that it is a dangerous thing to allow it to go out as even the implied opinion of this Association, that operations for cancer in general and especially for epithelioma are not curative. I place myself firmly on the position that carcinoma is curable, provided you operate early enough and thoroughly enough. There is a pathological law which I believe applies to this matter which is, that if you do not remove the whole of an organ infected with carcinoma, you not only have no assurance that the disease is removed and will not return, but you are almost certain that it will return. On the other hand, if you remove the whole of the organ and certain tissues in the line of the lymphatics, there is a strong probability in carcinoma (not sarcoma) that the disease will not return. I have seen this in my own practice; I have seen it in the practice of Dr. Gross and other surgeons. I have no doubt that many here present can confirm the truth of this statement from actual observation.

SYNOPSIS OF THE TREATMENT OF A CASE OF ANEURISM OF THE LEFT SUBCLAVIAN ARTERY,

In Which Three Methods Were Successively Employed; Followed by Death.

By T. G. RICHARDSON, M.D.,

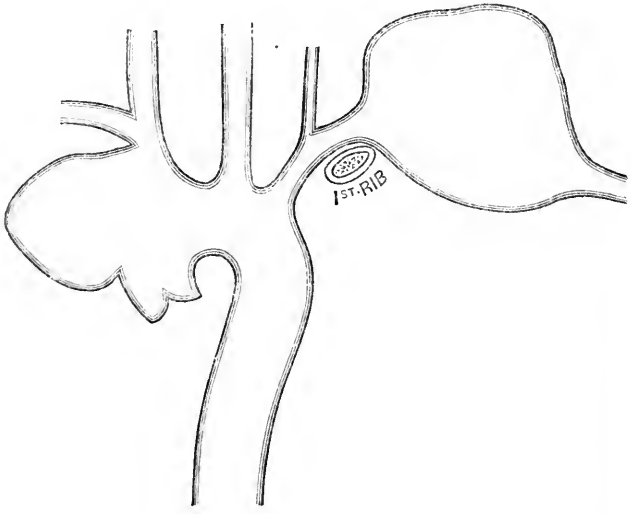
PROFESSOR OF SURGERY IN THE MEDICAL DEPARTMENT OF TULANE UNIVERSITY OF LOUISIANA, NEW ORLEANS.

The patient, a healthy, muscular Irish laborer, forty-seven years of age, was admitted to my wards in the Charity Hospital, October 19, 1885. I did not see him, however, until three weeks later, in consequence of my absence from the city. He gave no history of syphilis or other constitutional disease, and no account bearing upon his present condition, further than that for two years he had suffered with gradually increasing pain above the left shoulder, and concurrent loss of power in the left arm; and that about five months since he discovered above the corresponding collar bone a small pulsating tumor, which had grown steadily and gave him constant distress.

Upon examination the tumor was quite perceptible, occupying the base of the posterior cervical triangle, and by manipulation seemed to be about the size of a hen's egg, but much flattened antero-posteriorly and crowded downward behind the clavicle. As the pectoral muscles were broad and bulky, and the adipose tissue of the axilla largely developed, the extent of the tumor below the clavicle could not be satisfactorily determined; but its internal border was clearly defined by the external margin of the anterior scalene muscle. The cardiac sounds were normal, but just above the sternum was discovered a well-marked *bruit*, which was supposed to be transmitted from the aneurism in the neck, but which was found after death, to have proceeded from a similar tumor within the chest. The man's sufferings were somewhat

abated by his lying in a crouched position upon his left side, with his shoulder imbedded in pillows, but never sufficiently so to permit sleep, except when he was under the influence of chloral or opium.

1. Constitutional treatment. Before resorting to strictly surgical measures, I determined to make a fair trial of what is commonly known as the medical treatment, of which Mr. Tufnell is the modern apostle, and which has been undoubtedly successful in a few cases of internal aneurism. With this view, the patient was confined strictly to bed,



only as much food and drink allowed as was absolutely necessary, and the heart's action reduced by the use of the saturated tincture of veratrum viride, and iodide of potassium in doses of minims 5 of the former and grs. 20 of the latter, three times a day. At the end of a week no appreciable effect upon the growth or contents of the tumor having been produced, I concluded to abandon the sedative, permit a more liberal diet, and institute

2. Direct pressure. For this purpose I employed a compress and an ordinary rubber bandage, but the latter, necessarily carried across and around the chest below the opposite axilla, became almost unbearable, and was substituted by a broad leather belt around the waist, and an elastic band passing over the tumor and buckled to the belt in front and behind; the patient being allowed to regulate the pressure accord-

ing to the degree of discomfort produced. The compress was made of cork, padded with horse-hair upon its under surface, and covered with buckskin. The apparatus was all that could be desired for the purpose, and the patient being deeply interested in the result carried out his part of the programme most faithfully. I confess that I had strong expectations of a successful issue, and watched anxiously from day to day for a favorable change; but at the end of a month all that could be truthfully said of the procedure was, that it had slightly rearded the growth of the swelling. Satisfied now that something more heroic was demanded, and still unwilling to adopt proximal ligation with its yet unbroken history of disastrous results in such cases, I determined upon the

3. Introduction of surgical pins. Nineteen of these, measuring each an inch and a half in length, were passed through the anterior wall of the tumor at different points and in different directions, due care being taken not to injure any of the adjacent nerves or bloodvessels. The precaution of running the pins through bits of leather or some other such material to prevent their heads from becoming buried in the skin, not having been taken, several of the pins subsequently disappeared from view in consequence of the swelling which their presence induced in the subcutaneous tissues. For a day or two the tumor seemed to be growing harder, and I was encouraged to think that the desired coagulation of the blood-fibrin was taking place; but it soon became evident that the hardening was due to the inflammation of the skin and subjacent tissues, and that the tumor was growing more rapidly than ever. All the pins which were accessible were now withdrawn, and as the case seemed to be hurrying on to an unfortunate termination, I resolved, as a last resort, to employ ligation of the axillary artery and injection of perchloride of iron. This operation was attempted on January 13, 1886, just two months after the patient came under my immediate care.

Ether having been administered, a short longitudinal incision was made in the extreme lower border of the axilla, directly over the site of the artery. In consequence of suspected disease of the coats of the vessel, unusual care was taken to reach it through as small an opening as possible, and with the least disturbance of the surrounding tissue. After division of the skin and superficial fascia, I relied altogether upon the handle of the scalpel, blunt hooks, and forceps; but notwithstanding this precaution, only a little further progress was made, when I observed a small clot of blood making its way up slowly from the bottom

of the wound, showing that the artery beneath had been slightly torn in consequence of the thin and flimsy condition of its diseased coats. I immediately commenced plugging the wound with strips of lint wet with Monsel's salt, but in the act of doing this the clot was displaced, and a sudden gush of partly coagulated blood followed. Continuing to stuff the wound with the lint, I soon became convinced from the quantity of the latter required that the rupture had its seat in the lower extremity of the aneurism, as was subsequently verified by the dissection. However, I finally succeeded in arresting the hemorrhage, and then proceeded to inject by means of a hypodermic syringe half a drachm of a weak solution of perchloride of iron—one to twenty of water—into the centre of the tumor above the clavicle. The patient having recovered from the anæsthetic, was rendered comparatively comfortable by means of morphia, and remained so for twenty-four hours. At the end of this time no coagulation having occurred, and the blood beginning to make its way through the dressings, I made another injection double the strength of the former, but with no better success. The next morning an exhausting hemorrhage occurred, and as septicæmia had already set in and the dressings were exceedingly offensive, I endeavored to renew some of the latter, when a rush of blood compelled me to desist. I need scarcely add that death took place a few hours later.

Necropsy.—Upon dissection the tumor was found to be about the size of a man's fist and irregularly fusiform. It involved the entire third division of the subclavian and about three-fourths of the length of the axillary artery. Its pressure had caused partial absorption of the first rib, and almost complete obliteration of the left subclavian vein, the calibre of the latter being reduced to the size of an ordinary probe. A fairly thick layer of fibrin lined the interior of the sac in front, corresponding to the locality where the pins had been inserted, but elsewhere the walls were very thin, and at the distal extremity of the tumor exhibited a large rent produced by packing the wound made in the attempt to ligate the axillary artery. The subclavian artery upon the proximal side of the tumor was apparently healthy, although abnormally soft and inelastic.

Further investigation disclosed another aneurism, about the size of a billiard ball, situated upon the outer anterior aspect of the first division of the arch of the aorta, and involving the adjacent portion of the innominate artery, from its root to its bifurcation. Its walls were quite dense and strong, and lined with thin fibrinous laminæ. The bruit heard during life at the top of the sternum proceeded doubtless from this tumor.

A FEMORAL ANEURISM CURED BY ELEVATION AND FLEXION OF THE LIMB.

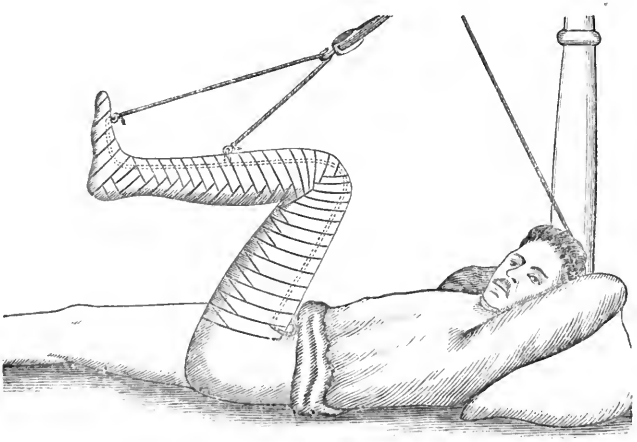
By T. G. RICHARDSON, M.D.,
PROFESSOR OF SURGERY IN THE MEDICAL DEPARTMENT OF TULANE UNIVERSITY OF LOUISIANA, NEW ORLEANS.

THE patient, an Italian, aged fifty-five years, a shoemaker by trade, was admitted into Ward No. 7, Charity Hospital, December 11, 1886, for a painful swelling in the left thigh, about four inches below the femoral arch. Examination readily determined beyond question the presence of a large aneurism of the femoral artery in the lower part of the femoral triangle. None of the characteristic signs were wanting. The tumor was an irregular flattened ovoid, about the size of a large goose's egg, and being easily reduced in size by direct pressure, when the entrance of blood was suspended by compression of the artery above, was supposed to possess thin walls. The man, although not lacking in bony development, looked fragile, anæmic, and apathetic, and gave a fairly clear deposition of having had syphilis eight or ten years before. The swelling in the thigh was first noticed about three months before his admission, and at that time was scarcely as large as a pigeon's egg. Its rapid growth had been accompanied by a great deal of numbness and pain, and, lately, by œdema of the limb below. There was some reason to suspect that the exciting cause of the disease was hammering leather upon an iron lap-stone, the latter resting upon the thigh immediately over the artery.

Reserving a day to select the method of treatment best suited to the case, and at the same time give the surgical staff of the hospital and the members of the medical class the opportunity of verifying or disputing the diagnosis, I directed perfect quietude in bed, a roller bandage from the toes up, and the limb supported in an easy position upon pillows.

The next morning the tumor seemed to be more tense and decidedly

tender upon handling, due probably to too much manipulation the day before. Somewhat alarmed by these symptoms lest serious inflammation might have already begun, I made preparations for tying the artery at my hospital clinic the succeeding day, and ordered in the meantime large doses of chloride of iron, milk punch, the best diet the hospital could afford, and morphia at night if necessary, on account of pain or wakefulness; and to facilitate disappearance of the œdema, and relieve the passive congestion upon which this depended, I requested Mr. Harnan, the student of the ward, to suspend the limb, flexed at or beyond a right angle, at the knee and hip-joints. This he succeeded in doing most satisfactorily by means of a Smith's anterior splint, bent to meet the indications, the limb being closely bound by a roller bandage to the under surface of the splint, and the latter



fastened by rope and pulley to a cross-bar resting upon two lateral supports. Although this arrangement was not perfected until late in the afternoon, I found the next morning that a wonderful change for the better had taken place: the œdema was nearly all gone; the tumor was much less tense and quite painless; the rhythmic expansion was greatly reduced; the bruit was indistinct and feeble, and the patient expressed himself as feeling quite comfortable. Thus encouraged, I deferred the intended operation and ordered a continuance. The second day the improvement was still more marked, and it was evident to the touch that coagulation of the contents of the sac was

taking place. At the end of the third day complete consolidation had occurred, and pulsation, thrill, and souffle could no longer be detected. Fearing lest I might disturb the progress of cure by change of position, I kept the limb suspended for ten days or two weeks, by which time the tumor had become quite solid, and considerably reduced in size. The patient assured me that he suffered no great discomfort, and it was quite evident to all that his general health had been decidedly improved by the iron, wine, and nourishing diet which had been abundantly given him. He was discharged a week later, but reported at the clinic from time to time for a couple of months, by which time only a small hard nodule could be felt at the original site of the tumor.[1]

As this is probably the first recorded original case of femoral aneurism cured by this simple method, I beg leave to call the attention of the Association to the fact that there was no direct pressure upon the tumor, as is generally sought to be exerted upon popliteal aneurism, when treated by forced flexion, but that the admirable result was due entirely to suspension and flexion of the artery at the groin and knee. I am inclined to give almost the entire credit to the former, and intend to test this opinion in the next case of popliteal aneurism which may come under my care, by suspending the entire limb in a vertical position. By this means the effect of gravity in reducing the force of the circulation will be disconnected from any other means save the bending of the artery at the groin. I take the liberty of suggesting this experiment to those of you to whom the opportunity may occur at an earlier date.

[1] A short notice of this case was published by the student of the ward in the New Orleans Medical and Surgical Journal for February, 1887.

WOUNDS,
THEIR ASEPTIC AND ANTISEPTIC MANAGEMENT.

BY DAVID PRINCE, M.D.,
OF JACKSONVILLE, ILL.

I. ASEPTIC.—*a.* By diminishing the amount of floating material in the air by means of filtration through cotton, for wounds in the process of formation.

b. Personal cleanliness.

c. By the subsequent seclusion of the floating material by investments that are proof against penetration by the dust floating in the air.

II. ANTISEPTIC.—By the employment of agents which are unfriendly or destructive to minute organic life, in such dilution as not to be injurious to the wound itself.

a. The dry antiseptic dressing.

b. The wet antiseptic dressing.

c. Drainage.

The importance of eliminating the greatest possible proportion of the atmospheric dust cannot be overestimated. The microscopist expects that some of his cultures will be contaminated by the accidental planting of germs from the air, in the course of exposure of the culture mediums, in the process of transfer of material from one receptacle to another.

For surgical purposes, it is important that all wounds made by the surgeon shall be alike protected from atmospheric implantation. The surgeon cannot afford to be as unsuccessful with his wounds as the bacteriologist with his culture mediums. The contamination of a wound implies complications which may thwart the object of a surgical operation and endanger the

life of the patient. The complete sterilization of a wound is a desideratum which is certainly possible to secure, and it is in the scope of the present endeavor to secure some advancement in this direction.

The wounds most difficult to protect from suppurative and putrefactive complications are those of the serous cavities.

The condition of the internal parts after a laparotomy, are like those of a sterilized material, infected to some extent.

The reason why all cases do not manifest the phenomena of decomposition, with the local abscesses and the general blood infection incident to decomposition, is, that in some cases the local vital forces are sufficient to produce an exudate that walls in, digests, and destroys the invaders, while in other cases the relative force is insufficient, and the invaders wage a successful war and secure a focus of decomposition.

Fluid left in the peritoneal cavity, blood-clots, portions of a tumor left unavoidably attached, and the material of sutures and ligatures, are in the condition of a prize, to be won by one party or the other.

The sutures and ligatures can be chemically treated by sublimate or other antiseptic, so as to resist attack by either party for a brief period, but the blood-clot, lifeless portions of a tumor, serum, and other exudates, are ready to be attacked by the leucocytes exuded from the blood on the one hand, or, on the other hand, by the germs introduced in connection with the air.

There are two precautions: One is to leave as little non-vital material in the wound or in the abdomen as is possible without injurious rough manipulation of the peritoneal surfaces, and the other is to permit the introduction of as few of the invaders as possible. It may be assumed to be impracticable to secure complete exclusion of either class of material favoring decomposition; the invading germs, and the lifeless food for their growth and multiplication.

The question is of the methods and details which will reduce both classes of agents to the smallest amount, and secure the greatest immunity for the greatest number of patinets.

I. ASEPTIC.—*a.* It is not necessary to the presentation of this subject, to go over the proof of the proposition that the bad behavior of wounds depends in part upon the particulate material floating in the air. That the agents of sepsis are not gaseous but particulate, is proved by the preservation of a great variety of substances when put into open vessels plugged with cotton, under such circumstances as to preclude the presence of these agents at the beginning of the observation. The ordinary method of sealing test tubes by means of cotton is a sufficient illustration.

The present status of opinion is well shown in a series of papers in the *American Journal of the Medical Sciences*, by W. Watson Cheyne, of London. In the number for January, 1887, p. 101, the microbes entering a wound are classed as

"1. Non-parasitic: those which are harmless though introduced in large quantities.

"2. Parasitic: those which require to be introduced in considerable quantity to do any mischief.

"3. Pathogenic: those which can live and multiply in the system, if only one microbe be introduced.

"When bacteria are introduced, there follows a struggle for existence between them and the cellular elements. Leucocytes quickly accumulate in the neighborhood of the mass of bacteria, followed by a fight for the mastery between the invaders and invaded. The cells take up the bacteria into their interior, where they are destroyed and removed, if non-pathogenic. When, however, the bacteria are virulent, the cells are themselves destroyed, undergoing degeneration, while the bacteria multiply, living upon the tissues which they decompose."

Cheyne discusses the question of the elimination of microbes, and thinks that those which are not destroyed and decomposed in the system get out chiefly through the kidneys.

In the same direction is this quotation from Klein (*Micro-organisms and Disease*), p. 167:

"Amongst the legion of different species of micrococci and bacilli floating in putrid substances, the great majority are quite harmless; when introduced into the body of an animal they are unable to grow and multiply and therefore are unable to produce any disturbance.

"But some few species there are which, although ordinarily growing and thriving in putrid substances, possess this power, that when introduced into the body of a living animal, they set up there a specific disease."

In the same direction is a statement from Staheli, of Bale (in the *Revue de Chirurgie* for August, 1886, p. 688):

"Fifty-nine wounds were dressed with oxide of zinc, of which forty-seven united by first intention, and in fifteen of these cases microorganisms were found. In the cases of union, notwithstanding the presence of microörganisms, these are called inoffensive marauders, such by their nature or by their quantity.

"It is well known that the question of a simple abscess or of a septicæmia depends upon the quantity of microbes injected."

His principal conclusions are:

"1. Under a dressing of oxide of zinc, wounds can be put beyond the reach of microörganisms.

"2. In general, the microörganism found in the secretions existed there already at the time of the operation.

"3. Union by the first intention is most generally prevented by the resence of the Staphylococcus pyogenes, S. p. aureus and S. p. albus.

"4. The wound secretions are good culture mediums."

These microbes go in class second of Klein.

This classification is further extended by Rosenbach, quoted in *Microörganisms in Diseases*, New Sydenham Society, 1886, p. 415:

"1. Staphylococcus pyogenes aureus.
"2. Staphylococcus pyogenes albus.
"3. Staphylococcus pyogenes citreus."

[Knapp[1] adds:

"4. Micrococcus tenuis.]
"5. Streptococcus pyogenes."

This last is similar to the micrococcus of erysipelas. It has special characteristics corresponding with Ogston's observation

[1] New York Medical Record, December 25, 1886, p. 702.

of the different modes of invasion of the staphylococcus and the streptococcus.

"The latter can penetrate into the living tissue, grow through it and live on it for a considerable time before suppuration occurs and the tissue breaks down. The same is true of the micrococcus of erysipelas. These two are supposed to act together, adding the suppurative element to that of erysipelas."

The last would arrange themselves in the class of pathogenic microbes of Klein.

Dr. Harold C. Ernst, in a report in the *Transactions* of this Society for the last year, makes thirteen pus-producing microbes.

A sterilized atmosphere.—To render the air aseptic, it may be kept still as in a closed box, or it may be strained through something which will hold the floating particles, or it may be carried for a considerable distance along some plane surface lined with glycerine or other substance to which the particles will stick.

The settling process is inapplicable for surgical purposes, because, however perfectly the floating material may have settled to the floor, the use of a room must disturb the air and bring a portion of the dust up again to float as before, and besides, the entrance of persons must, of course, permit the introduction of additional air which has not undergone the settling process.

The volumes of *Transactions* of the last two meetings of this Society contain descriptions of a device for separating these floating agents from the air by means of water. The plan was found to be reasonably successful, but some material would always get through, as proved by potato cultivations; fresh slices of potato being exposed for twenty minutes in the air thus treated, and then sealed up.

The present purpose is to explain a device for sterilizing air by passing it through cotton. To overcome the friction and drive away non-sterilized air surrounding a wound which is being made in a surgical operation, the force of a fan is employed which is run by an engine. By establishing a hurricane on one side of the cotton, a moderate wind is secured on the other,

having a force sufficient to overcome the effect of light specific gravity in the warm sterilized air. For surgical purposes, the addition of a small amount of steam is desirable, in order not to dry the exposed moist surfaces, and an arrangement for that purpose is seen in the drawing.

The surgical necessity for a temperature equal to that of the body, is secured by gas jets in the course of the pipe carrying the sterilized air. In this scheme the particulate material is supposed to be arrested by the cotton, which, at the end of the necessary period can be burned and new cotton supplied.

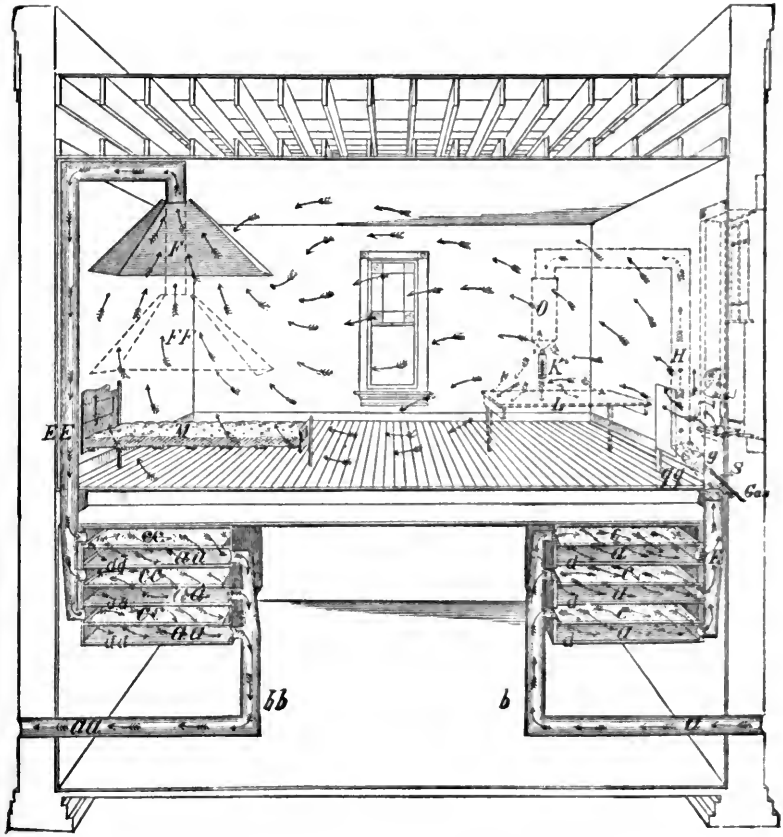
The arrangement is in the form of a chest of drawers, the outside of the chest being a cube of fifty inches. There are two chests. There are three drawers in each chest, each having an area of cotton 40x40 inches; equal to 1600 square inches; the area of the six being 9600 square inches. There are two air-tight floors, besides the lower floor of the box; one below the upper shelf and one below the middle shelf. The air enters above each shelf of cotton, and escapes below it. A sheet of woven wire with three-quarters inch openings serves as the support for the cotton, which is about an inch in perpendicular thickness. The arrows show the course of the current of air.

Observations are in progress to prove the approximation to perfection, of this device for depriving the air of the material in it, which is capable of starting and perpetuating changes in organic substances.

An experiment to determine the penetrability of cotton by gases while the particular material is arrested, has been made by burning sulphur in the air previous to its passage through the cotton, and finding that the sulphur dioxide passes readily through, while the particles which ordinarily give a blue tinge to the sulphurized air, have been arrested in the cotton mesh, leaving the air perfectly transparent.

The room in which this scheme has been worked out for *surgical* purposes, has a capacity of 3360 cubic feet.

The blower (No. 00 of the Sturtevant manufacture) revolves 3512 times in a minute. This is a rate of speed which makes very little noise, and is sufficient for the purpose. At this rate



a, Inlet pipe.
aa, Outlet pipe.
b, Ascending inlet pipe,
bb, Descending outlet pipe.
E, Ascending inlet pipe.
H, Ascending surgical pipe.
O, Descending surgical pipe, to be raised or lowered.
K, Thermometer.
Under *g* and over *gg* is the oblique *surgical* branch of the inlet pipe.
Gas, Gas flame for regulating the temperature of the air escaping from *O*.
S, Steam jet for regulating the moisture of the same air.
g, At the top of the straight pipe *g* is an eye looking at the flame below. Above *g* is the curved end of the inlet pipe for the *sanitary* use of purified air.
gg, Over *gg* is a screen to interrupt the straight horizontal blow of the same air.
EE, Descending outlet pipe.
F, Canopy.
FF, Canopy let down.
L, *Surgical* table *in section*.
M, *Sanitary* bed *in section*.
The important objects are in section.

c, *c*, *c*, 3 cotton filters for inlet.
cc, *cc*, *cc*, 3 cotton filters for exit.
da, *da*, *da*, 3 floors under the inlet filters.
dd, *aa*, *dd*, *aa*, *dd*, *aa*, 3 floors under the outlet filters

of speed, it is estimated by the manufacturer to carry 662 cubic feet of air in one minute. This rate of air-supply would completetely change the air of the room in five minutes.

There are, however, three elements of loss, viz., the slipping of the band, the escape by leakage through a long pipe, and the resisting influence of friction by which the fans of the blower slip on the air which they propel. It may be assumed that this loss amounts to one-half. The air of the room would then be completely changed once in ten minutes.

The accompanying cut illustrates an arrangement for sanitary as well as for surgical purposes.

A practicable plan of observation or test of the purity of the air thus treated, is to expose for twenty minutes a series of slices of fresh-boiled potato, or sterilized flasks or test tubes containing sterilized liquid, to the filtered air. These objects are placed on a table within the scope of the inflowing air which has passd through the cotton, after which the exposed material is sealed up for future observation. Similar material sterilized in the same way is to be exposed to the open air the same length of time and sealed the same way.

Another set of the same kind of preparations is subjected in the same way and for the same length of time, in any room in which it is desirable to test the condition of the air. Some observations have been made showing the superior purity of air thus treated, but perfection has not been reached.

The cotton is found not to arrest the particulate material in motion to the same extent as in still air. The cotton plug of a test tube is not the seat of any motion whatever. If, however, the attempt is made to blow through a tube closed with cotton, the analogy is perfect—the particulate material will gradually travel through, and in a little while it will become necessary to renew the cotton.

b. For completeness of classification, personal cleanliness should not be omitted. The hair brush and the nail brush are not less important than a bath and clean clothes.

Neglect of these may forfeit the good results of any amount of painstaking in everything else.

The surgeon is very likely to forget himself, and put his dusty head directly over a wound which he inconsiderately plants with whatever material may fall from it.

It is one of the good offices of the apparatus illustrated on page 355, to prevent the head from coming directly over a wound, and to blow away whatever dust may fall from it.

c. The prevention of the approach of the septic agents to a wound, after it is once made, was about twenty years ago a study by Guerin, of Paris. He employed cotton in large volume and refrained from examining the wound for many days. He was often successful in avoiding putrefaction, but the failures were too numerous for the general popularity of the method.

The employment of air-tight enclosures has been followed by no better success than the employment of cotton, which permits the flow and change of the air. The cause of failure was obviously the implantation of the germs of decomposition which proceeded to develop putrefaction and pathological changes under the seal intended to keep them out.

Once the invaders are in, of such kind and force, as to make head against the resident forces, they cannot be smothered in this way.

II. ANTISEPTIC.—The first attempt of Joseph Lister to neutralize the material falling upon a wound from the air was made in Glasgow nearly twenty-five years ago. (See the *Biennial Retrospect of the New Sydenham Society* for 1865–66, page 219.) After this sterilization, the wound was protected by medicated cotton or gauze from the approach of any more atmospheric dust.

Up to that time it had generally been thought the safest way, in the absence of the attempt to secure union by adhesion, or, in the failure of it, to keep the wound clean by frequent or perpetual irrigation.

During our civil war many substances were tried as wound lotions with varying success, all of which afterward yielded to the superior value of carbolic acid.

The desideratum has been to find some agent which could be employed in sufficient dilution to be safe to the exposed wound

tissues, and yet destructive to organic invaders when brought to the same surfaces. Nothing has yet been discovered superior to carbolic acid.

a. The dry antiseptic dressing. It is in the scope of this paper to mention the dry treatment and the wet. The preponderating force of Lister's opinions has given the dry treatment the general acceptance.

Two circumstances, however, are necessary to the success of the dry treatment.

First, the primary absence of the atmospheric dust, or that the floating particles lodging upon the surfaces shall be destroyed by the antiseptic agents—carbolic acid, sublimate solution, or other substances—or by the *digestive* character of the exudates from the wound, on the one hand, or, on the other hand, that there shall be included in the dressing some agent which is capable by its presence of preventing septic changes.

It may be claimed that if nothing is present in the air except the ordinary agents capable of effecting the decomposition of animal substances, the dry method is generally successful, but if there be exposure to pathogenic microbes or their germs, as those of erysipelas and gangrene, the dry dressing may be disastrous. There is no known vapor that is safe to the tissues and at the same time destructive to these agents.

The employment of oil containing ten per cent. of carbolic acid may be called a dry dressing, and comes the nearest to the indications, excluding all air and coming in direct contact with all exposed surfaces. Though this may not be a germicide, yet it is impossible for germs to develop or grow in it.

The question again arises, What will happen if pathogenic germs have been introduced below the cutaneous line of union, and, of course, beyond the reach of any agent employed in the dressing?

Drainage is employed to meet the difficulty by discharging fluids which most readily decompose if left enclosed in a wound, or permitting the escape of the products of decomposition.

Spray.—It may be most convenient here to notice the employment of carbolic spray during the formation of wounds or

immediately afterward. It is well enough settled that it is not a germicide, but it does not follow that it is useless.

One of the important things to be secured, is such a state of the exposed tissues as will most favor the production of a rapidly organizing exudate, capable of enclosing such germs or organic agents as may fall upon the surface and digest or dissolve them. It may be supposed from what is observed that the carbolic solution benumbs the organic invaders and retards their development until the cells in the exudation have had time to develop their digestive fluid by which the invaders are destroyed.

The criticism, therefore, that the spray carries more dust into a wound than would otherwise go there, is of no force, if a circumstance is secured favoring the destruction of this organic dust. The effects of various irrigations, made in the progress of a surgical operation, are partly explained in the same way.

The complete aseptic condition of the wound being secured, it is not important that the dressing should be any more than aseptic. The antiseptic agents can only act upon the surfaces. The interior of a closed wound must behave under a dry dressing, well or ill, as there may be agents producing decomposition introduced from without or coming from within through the course of the circulation.

It has been generally assumed that there must be a breach of surface for the entrance of the germs of purulent infection.

A crucial observation was made by Dr. Garre, assistant professor in Socie's private laboratory in Bale, Switzerland, an account of which is given in *Microörganisms in Diseases*, p. 441, New Sydenham Society, 1886.

"On June 17, 1883, a pure cultivation of the third generatiom from the pus of the same case of osteomyelitis (employed in previous observations) containing Staphylococcus pyogenes aureus, was employed in the following manner:

"After washing my left arm with distilled water, I took the whole of the cultivation from the test-tube and applied it by rubbing over the region of the supinators in the same manner that one rubs an ointment upon the skin. Agar-agar was rubbed over the right arm. Nothing pathological could be seen upon either forearm.

"Hyperæmia, with a sensation of warmth, became apparent on both sides and disappeared in less than an hour. Six hours later, there was a burning sensation in the skin upon which the inunction of micro-organisms had been made, which steadily became more intense and disagreeable. The sensation was like that produced by nettles. Redness and turgescence became more evident.

"In the course of the evening, pustules of the size of a pin's head developed around some hairs, and in the morning these were fully developed, so that pus was obtained for inoculation. On the eighth day pus from the depth of the abscesses was inoculated.

"With the exception of some neighboring furuncles, the suppuration had come to an end in three weeks, leaving seventeen scars.

"From this observation it is evident that furuncle, carbuncle, and whitlow are infectuous diseases, and that they can be caused by the same coccus as is found in acute osteomyelitis, and that the yellow pus-producing coccus found in these affections is identical."

This observer goes on to remark that the mode of application purposely employed in this experiment is in close analogy with what often happens accidentally. He thinks that in furuncle the infection finds its way through the ducts of the cutaneous glands, and that there are no grounds for assuming that the secretory organs of the skin behave differently toward infectious invaders from those of the mucous membranes. He refers to the effects of the germs of anthrax taken with food, and to cholera and typhoid fever, with reference to which it is not assumed that there must be some abrasion or wound of the surfaces.

Dr. H. Knapp, in the *Archives of Ophthalmology* for 1886, and in the *New York Medical Record* of December 25, 1886, gives a narrative of a large number of experiments upon the eyes of different animals, going through the ordinary surgical operations, and employing one eye for a clean operation and employing some pyogenic infection in the operation upon the other eye.

He draws from his observations the inference, that pyogenic microbes cannot attack healthy living tissues. They may live in the healthy fluids of the body, but they must wait for some deterioration of the vital forces before they can attack the tissues and develop an exudate, which is the essential element of pus.

The leucocytes occupy the position of accidental intruders into the exudate which is the work of the pyogenic microbe.

It is not enough for the surgeon to employ antiseptic precautions; the poison of an abscess about the teeth or elsewhere may give occasion to the entrance into the blood of pyogenic microbes which may enter a wound by the back door.

In one of his experiments, the left eye operated on septically showed the pus coccus, while there was no suppuration in the right eye operated on antiseptically, but some pyogenic microbes in it; and an abundance of these in the blood and in the kidneys. The microbes of the right eye seem to have come round from the left through the circulation.

From the facts and considerations adduced, it follows that external antiseptic precautions are not sufficient to prevent suppuration; that there is a back door through which the pyogenic microbes may enter, coming through the blood supply, travelling in the streams of the circulation, innocently as long as no tissue with depreciated vitality is presented, but ready to deposit themselves and to multiply when a diminished resistance is afforded; producing in one case a spontaneous abscess, and in another a suppuration in a wound or on an abraded surface, such as the peritoneum after its exposure to the air and to rough handling with fingers and sponges.

While the knowledge of the liability to suppuration in wounds without deriving from the air the causative agents, tends to diminish confidence in the immunity supposed to be secured by the external applications of antiseptic surgery, it at the same time directs attention to the internal preparation of the patient which has been long known to be important in securing good surgical results.

These internal elements of treatment are the use of medicines which are supposed to be antagonistic to the development and multiplication of those parasitic microbes which occasion fever, with a tendency to local suppuration with febrile symptoms. Among the most valuable of these medicines are quinine and iron. Recent observations are preparing the way for the introduction of antipyrin and antifebrin into this class.

b. The wet antiseptic dressing furnishes the greatest number

of safeguards against disaster in the management of wounds. Though the agents are not of sufficient strength to be germicides (or ought not to be), any germ development is in an offensive soil and can come to nothing. If the germ of any pathogenic microbe is included in a wound it will interfere with adhesion, or break up one already formed; but when the liquid of the antiseptic dressing is present, it is ready to go into the breach of continuity and stop the further devastation. On surfaces covered with hairs, though shaven ever so short, the dry material of a dry dressing is liable to be lifted up by the rise of the short stubs in the growth of the hairs, permitting the entrance of germs of decomposition to any unorganized exudate and occasioning its speedy decomposition.

The best agent for the wet dressing is doubtless carbolic acid in such dilution as to be slightly sweet, and applied once in twenty minutes so as to be always fresh. No redness of surface is occasioned by the application of carbolic acid in such dilution.

Unfortunately, however, there is danger of producing pneumonia when this plan of treatment is employed upon wounds of the breast or wounds anywhere over the ribs. Great care is necessary to avoid cold application to wounds upon the chest.

When there is fear that the requisite degree of warmth may not always be secured, a compromise may be made by very frequent changes of a dry antiseptic dressing with a thorough antiseptic irrigation. In all other parts of the body the temperature may be made to suit the feelings of comfort of the patient.

The greater the precaution against the implantation of germs of decomposition in a wound, the safer is the employment of a permanent dry dressing. The longer the exposure to ordinary air the greater will be the necessity for a wet dressing.

Wounds of accidents are generally exposed a considerable time, and for this reason there is the greater necessity for treating them with a wet dressing by a compress to which antiseptic liquid is applied every twenty minutes, or by perpetual irrigation —the antiseptic fluid falling in drops upon the wound, or by a perpetual bath. The bath is especially applicable to gunshot wounds in which there is a large amount of material destined to slough.

c. The question of provision for drainage is that of the

greater or less realization of the exclusion of the agents of decomposition, introduced from without at the time of an injury or operation, or arising within and coming from the circulation; compared with the further question of the introduction of infection along the surface of the tube employed for drainage. Another question is that of the comparative forces of vitality to master and destroy the agents introduced from without, and the power of these agents to resist the digestive or destroying vital forces.

It is well known that fluids retained in a wound, which resist the absorbing power of the living surfaces, have a strong tendency to pass into decomposition. The microbes introduced from without into this liquid or coming in by the back door, are shielded from the direct attack of the exuded leucocytes with their digestive forces. It seems that the white blood-corpuscles lose their vitality when floating in serum, while the invading forces are generally in the form of germs fallen into a favorable soil. The liquid is, therefore, in the condition of broth in a flask which has had its sterilization impaired by the introduction of microbes ever so few. If the fluid is a proper culture medium, it is a question of time, and the forces of nature can only resist by the establishing of a limiting exudate, resulting in the formation of a circumscribed abscess.

The removal of the liquid contents of a wound is attempted by capillary drainage, the best agent, doubtless, being sterilized fiddle strings, cut short enough. Under favorable conditions these will be subsequently absorbed.

In case of drainage by tubes, it is evidently necessary to aspirate and irrigate with such frequency as to prevent the colonization of the wound from without, after it has been finally closed up. The form of the drainage is of less importance than the carefulness of the management.

A plan of drainage for the peritoneal cavity, and applicable to other parts, has been introduced by Mikulicz, of Cracow, for the purpose of preventing the entrance of microbes along the outside of the drainage tube. (Proceedings of the German Congress of Surgeons, April, 1886, from *Revue de Chirurgie*, Dec. 1886, p. 1019.)

He prepares a piece of iodoform gauze of the size of a pocket handkerchief and attaches a strong silk filament to the centre. This is kept in a five per cent. solution of carbolic acid during an operation, and when the tumor has been removed and the peritoneum of the lower part of the wound has been stitched to the skin, the gauze is placed in the pelvis so that the silk filament goes to the bottom of the pocket, while the periphery is arranged like a tobacco pouch. The silk filament occupies the centre around which more gauze is introduced. The gauze thus comes in direct contact with the abdominal wound on the one hand, and the intestines on the other. The middle portion of the gauze can be removed and new gauze can take its place as long as liquid soaks into it.

At the end of forty-eight hours, the little bundles of gauze which fill the sac are removed, and in four days the sac itself is drawn out by means of the silk filament attached to the bottom of the funnel of gauze. This is replaced by a large rubber drain which is shortened from day to day.

A modification of this method is made by putting into the centre of this cone of sublimated thin silk or wool fabric having a thread attached to the apex a glass tube having the thread to come from the apex of the cone through the tube and out upon the exterior. A moderate amount of absorbing material is placed around the tube and inside the cone; each mesh of the absorbing material is to be afterward removed by a string attached, while the tube itself is to be plugged with absorbent sterilized cotton. The tube is to be aspirated every few hours until there is no more liquid produced. The object of the silk or wool material, is to make a connection with the surfaces until the natural seal by the exudations prevents the entrance of microbes into the general peritoneal cavity. After the withdrawal of the tube, the cone can be gradually inverted by drawing upon the apex by means of the string until the whole is pulled out. The exudates so penetrate the mesh of the pouch that it may be ten or fifteen days before it can be easily detached, but in the meantime the interior parts have become fully protected by adhesions.

SPLENECTOMY FOR DISLOCATED OR WANDERING SPLEEN.

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THE history of the following case may possibly prove interesting as a contribution to the surgery of the abdomen:

Mrs. C. A. G., aged twenty-nine years, was admitted to the female surgical ward of the Western Pennsylvania Hospital, Pittsburg, Pa., on May 6, 1886. She stated that for the past six years she had suffered from a tumor which occupied the left iliac region, and extended to the suprapubic region. This tumor was movable, and could readily be transferred to almost any part of the abdomen, either by alteration in the position of the body, or by combined external and internal manipulation (through the vagina). It was painless, and although known to exist during the past six years, did not attract special attention until about four years ago, when, after an attack of vomiting of blood, it increased rapidly in size for a time; but during the past year, did not seem to have grown appreciably. In addition to the presence of this tumor the patient had suffered severely from attacks of hæmatemesis, these attacks generally coming on suddenly, continuing with great violence for several hours, and then gradually subsiding.

Her family history is excellent—her parents are still living at the age of seventy years—her brothers and sisters are living and in good health, except one sister, who died in early adult life of "some obscure nervous disorder." She has never had ague, though living in a malarious district. She menstruated at thirteen, and has been regular ever since, until about one year ago, when, after a profuse hemorrhage from the stomach, she "missed her periods" for several months, and she has not menstruated since the occurrence of the hemorrhage

in March last. She has been married for seven years; has no children, but has had three miscarriages, the last one probably the result of large doses of ergot administered in the effort to control an attack of hæmatemesis.

The first attack of vomiting of blood occurred in 1882, two months before her second miscarriage; a second attack occurred ten days later; a third in about six months (this attack was attended by copious discharge of blood from the bowels); a fourth attack occurred in July, 1883, also attended by very free discharge of blood from the bowels; a fifth in September, 1884; a sixth in July, 1885; a seventh in December, 1885, and an eighth in March, 1886. These attacks were characterized by great severity and sudden onset, the woman usually waking from a quiet sleep with a feeling of intense nausea, which was speedily followed by profuse vomiting. The vomited blood was always pure and unmixed with food, even in the last attack, which set in within a half hour after she had eaten a hearty meal. She suffered no pain during any of the attacks, and her appetite was usually good. She stated that she always noticed a marked increase in the size of the tumor some days preceding the onset of the vomiting; that it pulsated violently during the continuance of the hemorrhage, and that it diminished in size when the hemorrhage ceased.

These attacks of hæmatemesis became more and more severe with each recurrence, continuing until she was entirely prostrated by the loss of blood, and at the last attack, until she was pulseless and apparently dying.

At the date of her admission to the hospital, she was in a condition of extreme anæmia and exhaustion; her face was pallid, waxen, and almost icterode, her lips and conjunctivæ colorless; her body emaciated, her pulse feeble, frequent, and compressible. She was restless, and complained of chilliness, alternating with flashes of heat, of drowsiness, faintness, tinnitus aurium, and of double vision. Physical examination revealed the existence of a smooth, roundish or oblong, elastic or semi-solid tumor, occupying the left iliac region, and extending to the suprapubic region. Its surface was apparently flattened, free from nodulations or irregularities; its outline was sharply defined, and it measured about five inches in each diameter. It was very freely movable, and could readily be pushed from its location in the iliac region to the level of, or even above the umbilicus; but it speedily gravitated back to its favorite resting place in the left iliac region. Examination per vaginam showed that the tumor extended deeply into

the pelvic cavity, occupying the left half of that cavity. The uterus was normal in size, was slightly displaced to the right side by the pressure of the tumor, but it was evidently entirely free from the tumor. The liver was normal in size, and there was no evidence of any renal disorder. The lungs and heart were normal, but there was a well-marked hæmic murmur. Percussion was abnormally resonant from the ninth to the eleventh rib on the left side.

The woman's condition was so unsatisfactory at the date of her admission to the hospital, that it was deemed prudent to postpone all operative measures until some improvement could be made in her general health, and she was, therefore, ordered full doses of quinine, with ferric chloride and dilute phosphoric acid. Under this treatment, together with a nutritious diet, she gained strength gradually; and by the end of the month was believed to be in condition to bear an operation.

On May 27, 1886, under strict antiseptic precautions, the abdomen was opened by an incision five inches long in the median line, its upper extremity terminating one inch below the umbilicus. On holding aside the lips of the wound, the upper end of the tumor became plainly visible; the lower end dipped down into the pelvic cavity, and was covered by a broad and very vascular fold of omentum. A portion of this omentum, as wide as the hand, and traversed by very large and tortuous bloodvessels, extended over the tumor and down into the pelvis, where it was firmly attached to the posterior and external surface of the tumor. In the effort to lift the tumor (which was now recognized to be the spleen) from its position, these omental adhesions gave way, but the bleeding which followed was at once arrested by clamp forceps. The capsule of the spleen also yielded, tearing pretty widely at a point close to the hilum, this tear being followed by a momentary, but very profuse gush of blood. This was controlled promptly by the hand of an assistant, who grasped the ruptured portion and applied pressure sufficient to arrest the bleeding. The pedicle of the tumor was then transfixed and secured by a double carbolized silk ligature, a second ligature being applied as an additional safeguard against hemorrhage. The omental adhesions were treated in a similar manner, the ends of all the ligatures being cut short and dropped into the abdomen. The peritoneal cavity was then carefully cleansed of all blood-clots; and the abdominal wound closed by silver wire sutures passed so as to include the peritoneum. The patient became very feeble during the operation, and several hypodermic injections of brandy and ether

were required for the purpose of stimulating and sustaining her extremely feeble circulation.

She reacted well from the immediate effects of the operation, and at 6 P.M. had a pulse of 100, a temperature of 99$\frac{1}{5}$°, and normal respiration. During the ensuing six days her condition was very favorable, her temperature never rising above 100$\frac{4}{5}$° and her pulse ranging from 88 to 100 per minute. Her bowels moved naturally and freely on the third day after the operation.

The incision wound was entirely healed by the fifth day and all the stitches were removed on the seventh day. On June 3d, seven days after the operation, she complained of tenderness and pain in the left iliac region, and this became aggravated during the following day, the pain and tenderness extending in the line of the internal saphenous vein. This marked the onset of a rather severe attack of phlegmasia alba dolens. The entire limb, together with the left buttock, loin, and left side of vulva, became tensely swollen, œdematous and tender; and there was a marked increase of febrile excitement. This complication yielded slowly to a tonic and supporting plan of treatment with elevation of the limb, and by June 18th the pulse and temperature were nearly normal, the œdema was subsiding slowly, and she was free from distress. She was discharged from the hospital June 29, 1886, thirty-three days after the operation. Her health continued to improve, she gained rapidly in flesh and strength, and she reports that she is now entirely free from all her former sufferings. She menstruated in September, 1886, and again in October, but, shortly after that occurrence became *enciente*, and is now in the eighth month of pregnancy. She states that aside from a slight degree of swelling and weakness which still remains in the left limb, her health is excellent, and that she has no illness since her discharge from the hospital, that she "has been able to perform without discomfort all the duties incumbent upon a farmer's wife."

The spleen weighed fourteen ounces, after a quantity of blood had been allowed to escape from it. Its color was paler than normal, and, both in color and consistence, it resembled somewhat a greatly enlarged kidney. It measured five by five and a half inches, was quite vascular and friable on section. Microscopic examination revealed nothing abnormal, beyond slight thickening of the trabeculæ and intercellular connective tissue. The patient's blood contained more than the normal number of white blood-corpuscles, but the number was not sufficient to constitute leukæmia.

The operation of complete excision of the spleen for all causes has now been performed fifty-two times, with a mortality of 62.8 per cent. In addition to these complete excisions, the table given by Otis in the *Medical and Surgical History of the War*, Part II., vol. ii. pp. 152–3, shows partial excision to have been performed in twelve cases for various injuries of the organ, all the cases recovering. By reference to this table and to the table of Mr. Herbert Collier in the *Lancet* of February 11, 1882, it will be seen that the operation of excision of the spleen for injury, as well as for dislocated or wandering spleen, and for hypertrophy, uncomplicated with leukæmia, offers a very gratifying degree of success, thirteen operations giving eight recoveries. On the other hand, the same tables show a ghastly record of blood and death, for the cases in which the operation was performed for hypertrophy of the spleen, associated with leukæmia, sixteen cases in all, without a single recovery.

The chief source of danger in the operation arises from the marked tendency to hemorrhage, a tendency unfortunately present in all cases of splenic disease, and the mortality following the operation is due, in a large majority of the fatal cases, to this cause; uncontrollable hemorrhage occurring during the operation, or setting in a very few hours after the operation had been completed, the latter condition being due either to slipping of a ligature, or to a profuse general capillary oozing. Thus, in Mr. Bryant's first case, death occurred from hemorrhage in one and a half hours, and in his second case death resulted in fifteen minutes from "uncontrollable hemorrhage" from rotten adhesions connecting the spleen to the diaphragm.

Küchler's case died in two hours from hemorrhage. Köberle's "soon after," from the same cause, the patient never recovering consciousness. Spencer Wells's first case died from hemorrhage "in a few hours;" his second case from hemorrhage or shock during the operation. Billroth's first case died in four hours from hemorrhage due to slipping of a ligature; his second in one hour, from "uncontrollable bleeding from adhesions." In Simmon's case hemorrhage set in at the end of two and a half hours. Czerny's case "died in a few hours;" Arnison's in five hours; and Fuch's in eighteen hours, all from hemorrhage.

Recovery in the successful cases is reported to have been retarded by phlegmasia alba dolens in only one case, that of J. Knowsley Thornton. This case ultimately recovered, and the woman was in good health at the date of the report, two years after the operation. In the case now reported the phlegmasia was a very alarming and troublesome complication, and convalescence was prolonged in consequence.

Hæmatemesis as an attendant symptom or complication of splenic tumor is rare, and its presence is not noted in the histories of any of the other cases which have been submitted to the operation of splenectomy. Four cases, however, have fallen under the observation of Professor Osler, of the University of Pennsylvania, who has published a report of these cases in the *Canada Medical and Surgical Journal*, vol. xi.

The results obtained since the publication of Mr. Collier's tables, show a steady and very gratifying improvement in the percentage of recoveries. The table appended to this paper includes all the cases operated upon since 1881, of which I have been able to find any record—nineteen cases in all, with thirteen recoveries, and included among the successful cases are two, those of Franzolini and Alessio Giovanni, in which the splenic disease was probably complicated by leukæmia.

It is possible, however, that all the fatal cases have not been reported. Thus, Tait refers (*Diseases of the Ovaries*, fourth ed., p. 225) to two cases within his knowledge, in one of which the splenic tumor was mistaken for an ovarian cyst, and in which the operation of splenectomy was followed by a fatal result, in both cases. In the discussion which followed the report of Credé's case to the German Surgical Society (*Centralblatt für Chirurgie*, 29, 1882) six other cases were mentioned by different operators, with but one recovery.

However this may be, the success attending the operations is so very encouraging that we may hope that even in cases of hypertrophy, complicated by leukæmia, excision of the spleen will not always merit the condemnation which it receives at present, and not always be regarded as "physiologically unsound and surgically unsafe," as Mr. Bryant characterizes it, nor as the "useless and deadly experiment," which Mr. Collier considers it to be.

A Table of Published Cases of Operation for Extirpation of the Spleen which have been Performed since July, 1881.

Date.	Operator.	Patient.	Nature of disease.	Duration.	Operation.	Result.	Reference.
1881, July.	F. Franzolini, Turin.	Female, 22. Sickly since childhood.	Hypertrophy of spleen; increase in number of white blood-corpuscles.	Tumor recognized in 1880.	Incision in median line 22 centimetres long.	Recovery; convalescence delayed by pleuritis; tumor weighed 61 oz., measured 9½ by 10 inches.	Wiener med. Wochenschrift, No. 20, 1883.
1882.	Crede, Jr., Dresden.	Male, 44.	Hypertrophy of spleen following injury; cystic degeneration	Tumor noticed about one year previous to operation.	Incision in median line; attempted to remove cyst, but was compelled to remove whole organ.	Recovery in 4¼ months.	11th German Surg. Congress.
1884.	Billroth, Vienna.	Female.	Sarcoma of spleen.	Two years.	Incision in median line.	Good recovery.	13th German Surg. Congress.
1884.	Koeberle, Strasbourg.	Female, 46.	Hypertrophy of spleen; consecutive to intermittent fever.	Liver enlarged, abundant serous exudation and œdema of extremities.	Spleen measured 16 in., and weighed 17 lbs.; great loss of blood.	Death in 20 hours; supposed to be from intracranial hemorrhage.	Journal d. Accouchements, May 30, 1884.
1884.	Younker, St. Louis.	Female, 32.	Dislocation of spleen.	.....	Incision in median line.	Recovery; spleen 3 or 4 times larger than normal.	Amer. Medical Journal, July, 1884.
1884, June 11.	Terrier, Paris.	Female, young girl.	Hypertrophy; leucocythæmia.	Two years.	Median abdominal incision; spleen weighed 13 lbs.	Death in 20 hours from capillary hemorrhage into peritoneum.	N. Y. Med. Record, Aug. 9, 1884.
1884, Apr. 22.	J. K. Thornton, London.	Female, 19.	Hypertrophy; commencing cystic degeneration, increasing and painful.	Had existed two years.	Incision in median line.	Recovery.	British Medical Journal, April 13, 1886.

Date.	Operator.	Patient.	Nature of disease.	Duration.	Operation.	Result	Reference.
1884, Mar. 3.	Prof. Rydygier (Culm).	Female, 31.	Splenic tumor; leukæmia.	.....	.....	Death in 24 hours from hemorrhage from abdominal wound; spleen weighed 6 lbs.	Lancet, 1884.
1884, Oct. 14.	Alessio Giovanni	Female, 43.	Pernicious anæmia; chronic hypertrophy of spleen.	Chronic.	.....	Reported doing well 72 hours after operation.	Gaz. degli Ospitali, Oct. 26, 1884.
1885.	Prof. Albert, Vienna.	Female, 34.	Tumor in left hypochondrium; painful on standing or walking; great increase of white blood-corpuscles.	Tumor had existed for a month.	Extirpation; adhesions to tail of pancreas.	Wound healed in four weeks, and woman perfectly well; great increase in red blood corpuscles after operation.	Centralblatt für Chirurgie, No. 24, 1885.
1885, Nov. 6.	F. A. Roddick, Montreal.	Male.	Rupture of spleen; wound of abdomen; laceration of kidney.	.....	.....	Death in six hours.	Montreal Medico-Chirurgical Society.
1886, April.	J. K. Thornton, London.	Female.	Hypertrophy of spleen.	Chronic.	Median abdominal incision.	Death from internal hemorrhage.	British Medical Journal, April 13, 1886.
1886,	S'r Don Ribera, Madrid.	Male, 10.	.....	.....	.....	Death next day from shock.	Lancet, Dec. 4, 1886.
1886, May 19.	Prof. W. M. Polk, University of New York.	Female.	Dislocation of spleen.	Several years.	Incision in median line; spleen adherent to uterus and bladder.	Recovery; patient now in excellent health.	Report of case not yet published.

Date.	Operator.	Patient.	Nature of disease.	Duration.	Operation.	Result.	Reference.
1886, May 23.	Prof. A. Ceci, University of Genoa.	Female, 17.	Congenital hypertrophy of spleen; tumor very movable, floating from hypochondrium to front of abdomen.	Since birth.	Incision in median line; tumor weighed 77 oz.; splenic artery as large as subclavian.	Recovery; Violent delirium followed the operation for two days; great prostration; pulse could not be counted; respiration 70 to 80. Reported to be in excellent condition in 31 days.	Gazzetta degli Ospitali, 1886.
1886, May 27.	James McCann, Pittsburg, Pa.	Female, 29.	Wandering spleen; violent attacks of hæmatemesis; great anæmia.	Six years.	Incision in median line.	Recovery; convalescence complicated and retarded by phlegmasia alba dolens.	
1886, Oct.	Wm. H. Myers, Fort Wayne, Indiana.	Female.	Suppurating spleen in peritoneal abscess; two sinuses leading into abscess.	.....	.....	Recovery.	Journal of the Amer. Medical Association, April 2, 1887.
1886, Nov. 22	A. G. Podrez, Kharkoff, Russia.	Female.	Hypertrophy of spleen with ascites and extreme cachexia.	.....	.....	Recovered from effect of operation, but died on Dec. 27, 1886, from parenchymatous nephritis.	Lancet, Feb. 26, 1887.
1886, Nov. 23	J. R. Nilsen, New York City.	Female.	Floating hypertrophied spleen; severe pain over site of tumor.	Not stated.	Incision in median line below umbilicus; spleen weighed 2 pounds	Recovery; "entirely free from distressing symptoms."	American Journal of Obstetrics, January, 1887

A NEW KOLPOPLASTIC OPERATION FOR ATRESIA OR DEFECT OF THE VAGINA.

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WHEN an atresia of the vagina, whether congenital or caused by inflammation or injury, is somewhat extensive, the common experience has been that, although dilatation, even up to full size, is usually comparatively easy, it is difficult to keep the new-formed canal from retracting; the constant use of the glass plug for this purpose is such an inconvenience that the patient will most often get tired of its use, and leave it out whereby the atresia will recur.

Where the atresia is limited, forming as it does in some cases a thin perpendicular septum only, it requires but crucial incisions and a little subsequent dilatation. In such cases there is no difficulty, because there is mucous membrane enough to cover entirely the canal.

But in extensive atresias, where mucous membrane is wanting, it is, so to speak, contrary to the laws of physiology, that a canal formed by violence in uncovered connective tissue, should not retract. When such a canal is not covered with skin or mucous membrane, and not constantly kept open, either by mechanical appliances from without, or a constant evacuation of secretion from within, there is nothing to prevent the canal from ceasing to exist as such. This is the law for fistulous canals all over the body, and must hold good for a new-formed canal in the place of the vagina as well.

There are, however, many cases on record in which even extensive atresias of the vagina after gravidity have shown, at the time of delivery, a remarkable softening of the walls and dilata-

tion, so as not to cause the expected impediment to the delivery of the child. It is not unlikely that the succular and softened condition of the external genitals found toward the end of pregnancy is able not only to counteract the effects of the retraction, but even to permit of a certain permanency of cure. Breisky remarks in this respect as follows:[1]

"The artificial dilatation of more extensive stenosis in non-pregnant women by means of sponge tents, dilators, and other mechanical means, is usually partial and insufficient, and the success of only short duration. Amussat's operation of rapid dilatation with blunt instruments, as the handle of the scalpel and the fingers, is not any more efficient.

The first to propose to obviate these difficulties was Heppner, of St. Petersburg, who, in 1872,[2] made the following proposal when operating for congenital absence of the vagina: he made an H-shaped incision at the place of entrance, and having loosened an anterior and posterior flap, and made a vaginal canal in the usual manner, by dilatation with blunt instruments, he turned the two flaps into the new-formed canal, and secured them in position with sutures. Heppner's plan of operating has never had many followers, because the flap thus made must necessarily be too short for the more extensive defects of the vaginal canal.

Credé, in 1883,[3] tried to remedy this difficulty by taking a sufficiently long and broad flap of skin from the labium majus (Fig. 1). In his introductory remarks he says: "It is remarkable how often it is reported that the result of the usual operation for atresia was nil, or insufficient." In a case of acquired stenosis of the vagina caused by chronic ulcerative vaginitis—the usual method of blunt dilatation had been tried in vain by renowned gynecologists. Credé, therefore, decided on a plastic operation, as follows: he loosened the left labium majus from

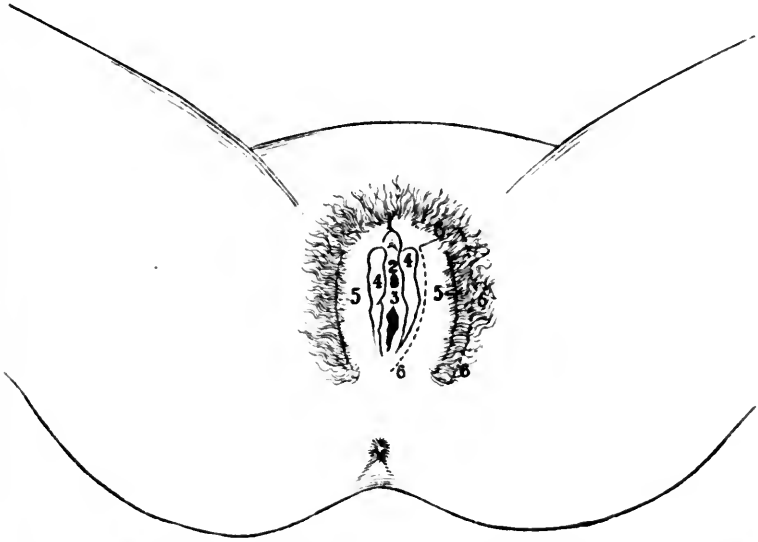
[1] Billroth and Lücke: Chirurgie, part Gynäkologie, die Krankheiten der Vagina, p. 57.

[2] Petersburger Medicinische Zeitschrift, 1872, p. 552.

[3] Archiv fur Gynäkologie, 1883; Bd. 22, H. 2, S. 229 (Heilung der Stenosis Vaginæ durch Einnähen eines Hautlappens).

above downward, leaving the base of the flap behind the vagina and in the left half of the perineum. The flap was 12 cm. long and 6 cm. broad, and when planted on the dilated vagina, and united by sutures to the cervix, it healed without difficulty and

FIG. 1.



1. Clitoris; 2. Urethra; 3. Defective vagina; 4. Labia minora; 5. Labia majora; 6. Incision for flap, consisting of left labium majus and its surrounding skin on the outside, and of the skin of the perineum.

relieved the patient from her sufferings, consisting of dysmenorrhœa, pelvic pain, and a discharge which corroded the external genitals, so as to cause constant pain and irritation. He states that three weeks after the operation the vagina was sufficiently large and the patient suffered no pain, that the hairs on the flap implanted caused no disturbance, and the patient, who was fifty years of age, was restored to comfort.

Last year, a case of extensive atresia came under my care, in which the usual methods of treatment had proved entirely inefficient. I consequently had to resort to some plastic operation.

It appeared to me that even Credé's perfected method did not meet all the requirements, inasmuch as the use of a single flap

would not be likely to be sufficient to cover the walls of a canal like the vagina; further, it seemed to me desirable to have the vagina covered, not with skin, but with mucous membrane, if possible. To this end I operated in the following manner:

E. N., twenty-seven years of age, came under my care in Cook County Hospital, June 30, 1886. Parents living and healthy. Had measles and scarlet fever during childhood, partial deafness following the latter disease. At the age of thirteen, she began to have menstrual molimina, backache, and pain over the suprapubic region of a spasmodic character, and occurring at monthly intervals, but there never was any menstrual discharge. The free intervals between the molimina gradually diminished until she reached the age of sixteen, when she had pain most of the time and was often confined to her bed.

About a year later she noticed a tumor in the abdominal cavity, which gradually increased until it attained the size of a head. At this time, about eleven years ago, Dr. William H. Byford performed the operation for hæmatometra at Mercy Hospital. He found an absence of the lower two-thirds of the vagina, and made a passage from the vulva to the upper third of the vagina, and evacuated the retained menstrual fluid. The patient was up and around in two weeks, but a fortnight later was compelled to go to bed on account of fever and pain in the pelvis and suprapubic regions, where subsequently an abscess formed, which was opened above the pubes, and continued to discharge for several months. The menstrual flow did not appear until about a year and a half later, when it came on at regular intervals. It was always scanty and lasted only a few days.

For the last three months it has grown still more scanty, and the spasmodic pains have recurred in the back, down the thighs and in the pelvis so severely, that she is hardly able to get about. The last menstruation appeared in May, 1886, with hardly an appreciable flow.

Present condition.—Patient is healthy looking, well nourished, complains of pain in the pelvis and suprapubic region. Above the pubes on both sides are several nodular retracted cicatrices remaining from the abscess openings of years ago. Pressure at this point causes pain, but no distinct tumor can be felt. The external genital organs present the following conditions: The mons veneris and labia majora of normal shape and size covered with the usual amount of blonde hair. The clitoris is normally developed and so are the labia minora, the upper half of the latter being about a square inch in size. The exter-

nal orifice of the urethra is in the normal position about half an inch below the clitoris. Instead of the usual introitus into the vagina there is a shallow funnel-shaped depression consisting of hard cicatricial tissue with a smooth surface and not covered with mucous membrane. The apex of the funnel at the depth of one-half to three-quarters of an inch presents a narrow opening through which only a very fine probe can be passed in about two inches. Digital exploration in the rectum reveals at a depth of two to two and one-half inches a round body the size of an orange, slightly movable, the upper end of which the finger could not reach. Knowing nothing of the exact condition at the time of the operation for hæmatometra, I supposed this tumor to be the uterus dilated by retained menstrual blood. Diagnosis: Atresia of vagina from congenital absence of the latter and retraction of the passage formed at the operation for hæmatometra.

I performed the usual operation for atresia of this kind, as recommended by Emmet and almost all other gynecologists, in the following manner: On August 3d, the patient was anæsthetized, brought on the table in lithotomy position, the surroundings of the external genital organs having been shaved and disinfected. The hard cicatricial tissue at the entrance to the vagina was dissected away with scissors, a grooved director inserted in the narrow canal, and slight bilateral incisions made inward, sufficient to admit the end of the index finger. A urethral sound was now introduced into the bladder and held by an assistant and the left index finger introduced into the rectum. The opening into the vagina was now dilated with the right index finger, alternating with the metal handle of the scalpel. When the dilatation had extended inward about two inches, two ounces of pale pink muco-purulent fluid escaped and I could introduce a finger into the sac, which had thick rigid walls and a corrugated rough inner surface. The canal, which now admitted the finger, was dilated without difficulty outward to both sides, the loose connective tissue between the rectum and bladder offering very little resistance to the dilatation, until a transverse diameter of two inches was obtained.

Exploration through the rectum by the left index finger while the right index finger was in the sac and pulled the latter downward, showed above and behind the sac a small body about the shape and size of a virgin uterus. The tissues of both parametria were somewhat thickened and rigid so that I was not able to palpate the tubes and ovaries. As it was thus evident that the sac described above was the dilated upper portion of the vagina, I decided to enlarge the entrance

sufficiently to permit the passage of a glass plug up to the vaginal portion of the uterus.

Two Simon's specula were then introduced and showed a narrow entrance into the now empty sac. This entrance we were obliged to widen by radiating incisions through the thick wall, before a glass speculum an inch and a half in diameter could pass into the sac. Digital exploration at the uterine end of the sac failed to show any distinctly shaped vaginal portion of the uterus.

The hemorrhage during the operation was not very considerable. The wound cavity was irrigated with bichloride of mercury 1 : 4000; iodoform rubbed into the walls; a glass speculum introduced and held in place by a perineal antiseptic dressing.

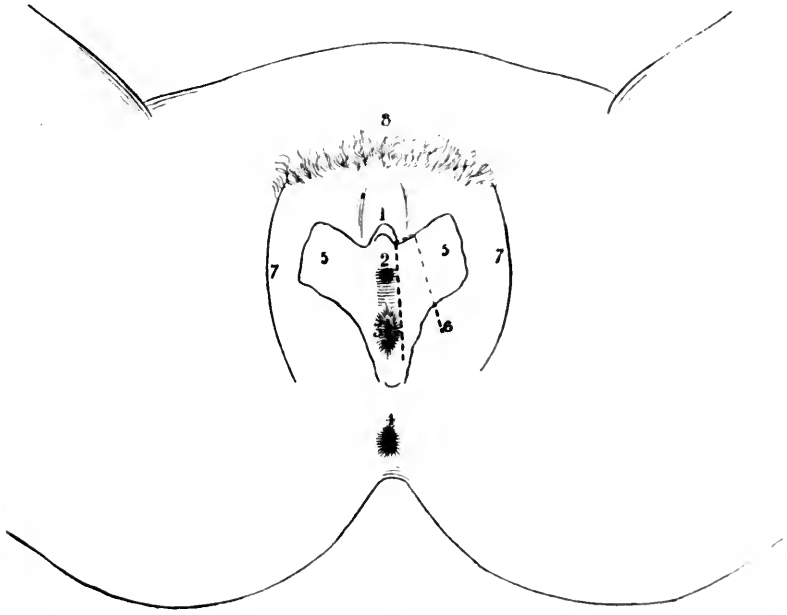
The patient was kept in bed for two weeks, no high temperature, pain, or inflammation following the operation. In the fourth week the menses came with a medium amount of discharge but no pain or other difficulties. During this period the glass plug was removed. At the end of the period, when the tube had been out for five or six days and the time had come for its reintroduction, I found that the new formed vaginal canal had already retracted so as to admit only the index finger, and the introduction of a larger glass plug caused her unbearable pain. I was therefore compelled to anæsthetize her, and repeat the forcible dilatation, which was accompanied by some hemorrhage, before I could introduce a glass plug of the same size as before.

This difficulty recurred at every subsequent menstrual period. I consequently determined to perform a plastic operation, with the expectation that if I could get a vaginal canal covered with skin and mucous membrane, the retraction would not recur. As Heppner's proposed flaps could be only comparatively short and entirely insufficient for a canal of this length, and as Credé's unilateral or posterior flap did not seem to me to fill the indications, at least, so far as cohabitation is concerned, I resolved to try to use the labia minora, which in this patient were normally developed, for the bilateral flap operation.

This I performed on October 26th, assisted by Drs. Van Hook, Davis, Black, and the surgical staff of internes in the hospital. The menses had just ceased. The patient was prepared in the usual manner and placed upon the operating table in the lithotomy position. The contracted vagina was dilated as usual to its full size, and the smooth part of the cicatricial surface freshened by scraping with the sharp spoon, and thoroughly irrigated by bichloride solution. The labia minora

were now loosened by incisions (as shown in Figs. 2 and 3); namely, a medial incision along the entrance to the vagina, upward along the

FIG. 2.



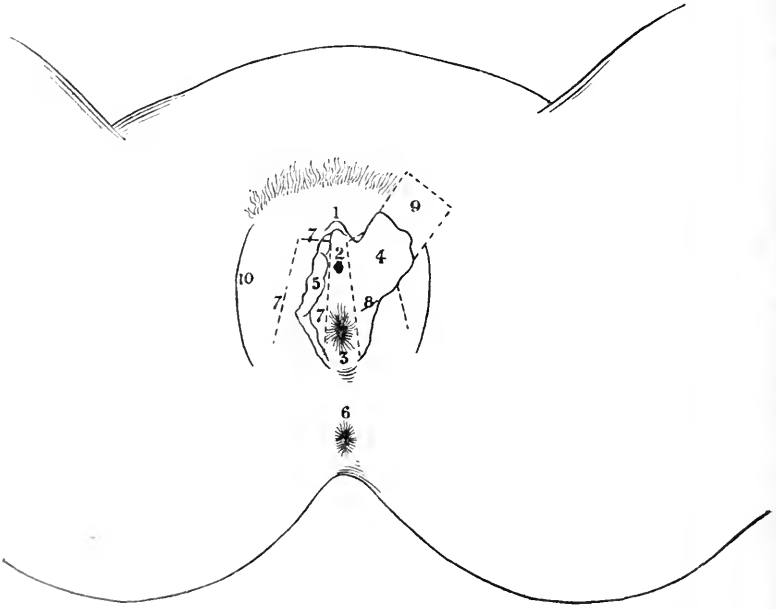
1. Clitoris. 2. Urethra. 3. Defective vagina. 4. Anus. 5. Labia minora. 6. Line of incision to liberate the labia minora. 7. Labia majora. Mons veneris.

side of the urethra to the clitoris. From this point a small transverse incision out toward the labia majora and from here a lateral incision carried downward, backward, and outward, so as to form a base for the flap one and a quarter inch in diameter at the lateral portion of the perineum. The whole of the labium minus was then loosened from the underlying muscles, forming a flap an inch and a half long. The upper quadrangular portion of the labium minus was then split lengthwise and the anterior or medial surface turned upward and outward (as shown in Fig. 3). By this procedure the flap was lengthened about an inch. The labium minus thus divided was in its upper part almost transparent and so thin that I was somewhat afraid it would lose its vitality from insufficient blood supply. My fears, as it afterward proved, were groundless.

Both labia minora having been prepared in the same manner, the

two lateral flaps thus formed were turned into the new-formed vagina. The upper borders were stitched to the lateral margins of the cervical portion of the vagina and the long lateral borders of the flaps secured by a few chrome catgut sutures to the tissue of the lateral wall of the new-formed vaginal canal, anteriorly and posteriorly, so as to prevent them from folding longitudinally.

FIG. 3.



1. Clitoris. 2. Orificium ext. urethræ. 3. Fistulous opening through the cicatricial tissue of the defect of vagina. 4. Left labium minus laid against the labium majus. 5. Right labium minus in situ. 6. Anus. 7, 7, 7. Line of incision for lateral (labial) flap of skin. 8. Part of incision dividing the labium minus so as to unfold it. 9. The unfolded labium minus. 10. Labium majus.

The vaginal cavity was now irrigated, thoroughly rubbed with iodoform, and packed with iodoform gauze. The loss of substance at the place of the transplanted flaps was without difficulty united by securing the movable skin of the labium minus by sutures to the mucous membrane at the place of the median incision. A flexible rubber catheter was left permanently in the bladder and an iodoform dressing placed over the vulva.

The after-treatment was uninterruptedly aseptic, and a week later

when the iodoform dressing was removed, complete union by first intention was found to have taken place, and the flaps were alive and everywhere adherent. Vaginal and external iodoform gauze dressings were applied for another week and then a glass plug an inch in diameter was introdueed. This was replaced a week later by a plug an inch and a quarter in diameter, and still later by one an inch and a half in diameter, which was introduced and kept in for several hours daily during the following months. At the subsequent menstrual periods during which the plugs have been left out, there has been no appreciable retraction of the vagina, and after the period the patient has been able to introduce the plug without either pain or hemorrhage.

The patient kindly consented to come before the Gynecological Society for examination, and the members of the Society were able to convince themselves that this new-formed vagina is wide, elastic, smooth, and covered with mucous membrane of some secretory power.

There can be no doubt that a plastic operation for atresia of the vagina is superior in its results to the old method of simple dilatation without transplantation of skin and mucous membrane on the wounded surfaces. It is desirable to have the walls of the new-formed vagina as similar to a normal vagina as possible. If a covering of mucous membrane, as from the labia minora, can be had, it is preferable to a flap of skin from the adjacent parts.

It is possible that cases of defect of the vagina may be complicated by defect of the external genital appendages, and that no labia minora exist. In such cases I recommend a bilateral flap of skin as preferable to Credé's unilateral flap. But in cases in which the nymphæ exist, a bilateral flap formed of them is preferable, can be had of sufficient size, and be used with almost perfect results.

INDEX.

Abdomen, gunshot wounds of, 155
Address of the President, 1
AGNEW, D. HAYES, 243
Aneurism of left subclavian artery, 341

Breast, sarcomata of the, 233

Calculi, vesical, to what extent can we classify, for operation, 79
Chloroform narcosis, puncture of heart in cases of, 275
Coöperative work in surgery, the need and value of, 1
Cranial and heart wounds, 243
Cystotomy, suprapubic, 9, 29

DENNIS, FREDERIC S., 9
Dislocated or wandering spleen, splenectomy for, 365
DUNOTT, T. J., 311

Femoral aneurism, 345
FENGER, CHRISTIAN, 375

GROSS, SAMUEL W., 233

Hypertrophy of the tongue, 311
Hysterectomy, vaginal, 323

KEEN, W. W., 193
KINLOCH, R. A., 183
Kolpoplastic operation for atresia or defect of the vagina, 375

Laparotomy in gunshot wounds of the abdomen, 155

MCCANN, JAMES, 365
MCGUIRE, HUNTER, 1
Medico-legal aspects of cranial and heart wounds, 243
MICHAEL, J. EDWIN, 227

NANCREDE, CHARLES B., 155

Packard John H., 29
Pistol-shot wound of abdomen, 183, 193
Prince, David, 349

Resection of the intestine and intestinal suture, process of repair after, 141
Richardson, T. G., 341, 345

Sarcomata of the breast, 233
Splenectomy for dislocated or wandering spleen, 365
Suprapubic cystotomy, 9, 29

Thompson, J. Ford, 323
Tiffany, Louis McLane, 261

Vaginal hysterectomy, 323
Vanderveer, A., 79
Ventral hernia treated by operation, 227

Warren, J. Collins, 141
Watson, B. A., 275
White and colored races, surgical diseases of, 261
Wounds, their aseptic and antiseptic management, 349

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